The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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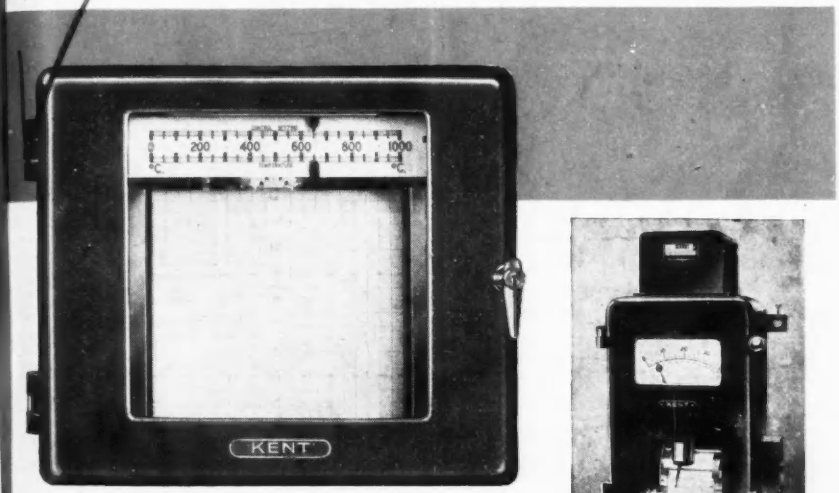

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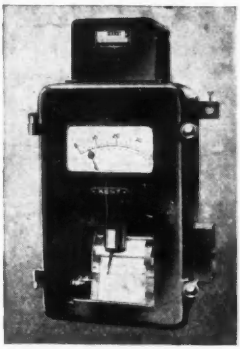

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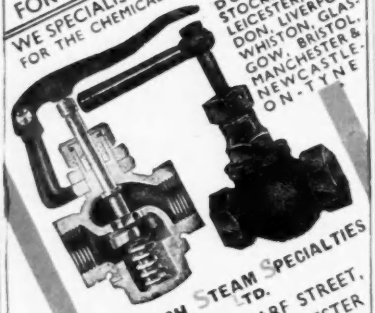

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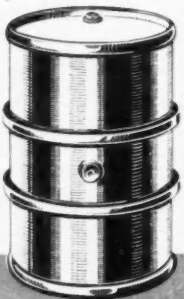

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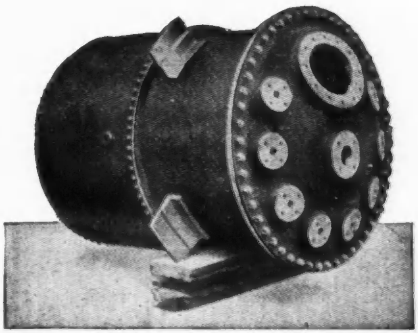

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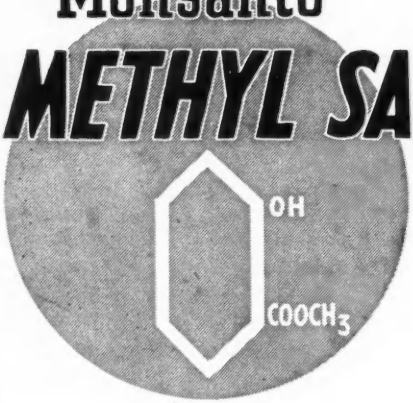

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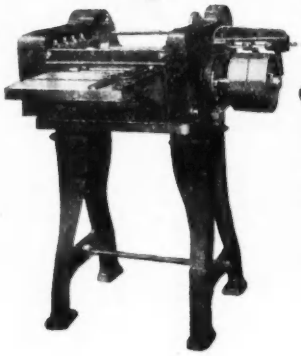

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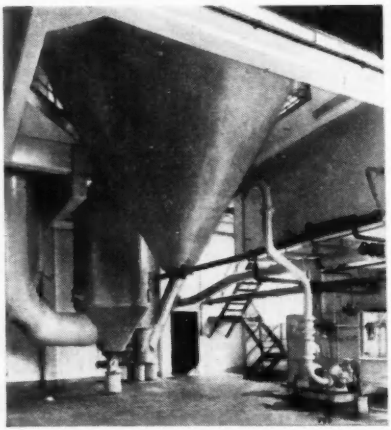

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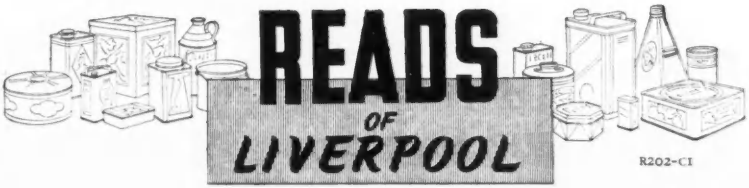

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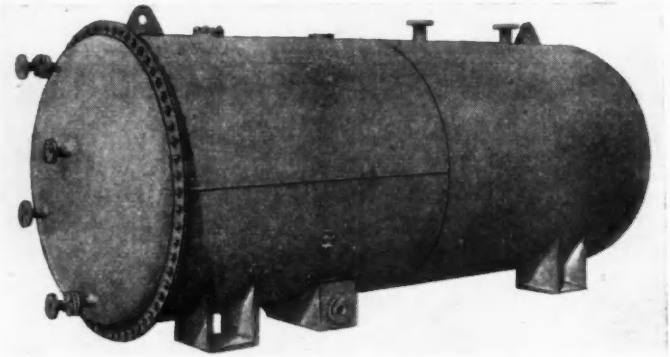

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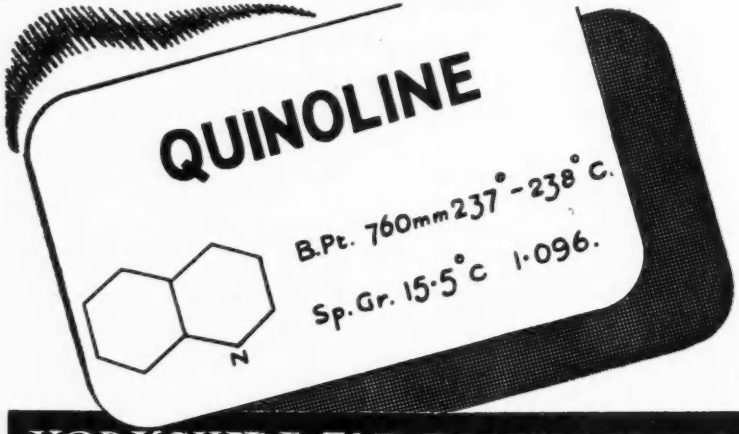

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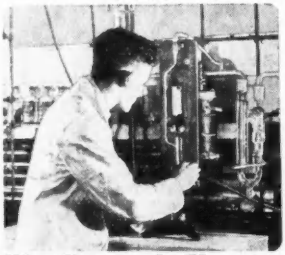

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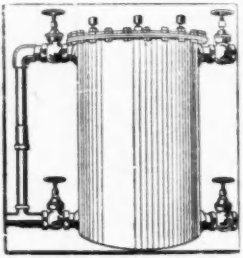

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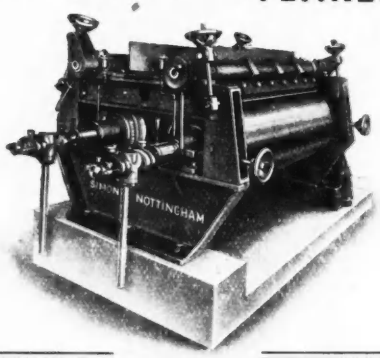

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VOL. LIII
No. 1379. — December 1, 1945 — Annual Subscription 21s. Overseas 26s.

Activation of Coke

COKE possesses properties as varied as those of most substances found in nature or produced in bulk through the agency of technical processes. Coke is not "just coke," as many chemists engaged in other industries may imagine. On the contrary, it may vary from the iron-hard beehive coke to the soft and friable semi-coke made from weakly-coking coals. The properties of cokes vary in the same way. Beehive coke may have an ignition temperature of the order of 600-650° C. (depending, of course, on the manner in which the measurement is made). Low-temperature coke may have under the same conditions a temperature of ignition below 450° C., sometimes below 400° C. Naturally, that property will be important when coke is used in the domestic grate, as everyone, be he chemist or road-sweeper, knows when he tries to light the fire with paper and sticks. To those wise souls who light the fire with a gas poker, temperature of ignition may be less important, but even with every modern aid, it is still a significant property because, without easy ignition, fresh fuel thrown on the fire will take a long time to burn up and may even put the fire out.

Another cognate property is that of combustibility. The so-called "hard" metallurgical coke has a high temperature of ignition; it burns with difficulty, and thus has a low combustibility, but when burnt in an adequate blast of air, it generates a very high temperature. There was fierce controversy before the war as to whether blast-furnace coke should have a high or a low combustibility; that controversy was never settled, but in practice the harder the coke, the less breeze it produces in handling and in the furnace, and the better it appears to be from that angle. There can be no question that coke to be satisfactory for the open grate should be of high combustibility.

The character and properties of coke depend also upon the method of manufacture. Gas-works manufacture a reasonably reactive coke in continuous vertical retorts, a coke of variable reactivity in horizontal retorts (which, however, owes its high reactivity at times to "black ends" left in from imperfections in the carbonising process), and a coke of rather low reactivity from intermittent vertical retorts. As gas coals are generally of lower rank than those used in coke ovens, the combustibility of

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gas cokes is generally greater than that of oven cokes. Generally, if a high temperature is needed with a furnace having mechanical airblast, a hard coke is required. For softer heat, and for all uses when there is no airblast, a softer coke is needed. A large quantity of coke is used for domestic purposes, and here a coke of ready combustibility is desirable. Even so, the burning properties of the coke depend upon the size of the material and upon the design of the appliance.

All these difficult problems involving the combustibility temperature of ignition of coke boil down to the fact that a great deal of the coke made in coke ovens is not suitable for domestic purposes, and is quite unsuitable for the open grate: much of the coke made in gas-works is suitable for the domestic market, but would be better if it were more combustible. Increased combustibility can be secured by carbonising at a lower temperature, leaving volatile matter in the coke, but this is regarded as expensive by the gas and coke-oven industries. It can also be secured by blending coals of lower rank with good coking coals, but this may be too expensive on account of transport costs.

In these circumstances, Mr. P. J. Askey and his colleagues started some years ago to work on an observation of Professor Cobb that coke containing sodium carbonate is more reactive and burns very much better than untreated coke. The sodium carbonate can be mixed with the coal before carbonisation or can be added to the coke after carbonisation. There is nothing new under the sun, however, and Mr. Askey himself has lately drawn attention to an older patent of 1897 in which alkali activation is described in some detail with the further observation that "coke in which there has been incorporated before or after its formation say, for example, ½, 1, 2, 3, or 4 per cent. of carbonate of soda . . . ignites more easily and burns better than ordinary coke."

The results of this work have been given in a paper presented by Mr. Askey to the Coke Oven Managers' Association. The possibility of damage to the brickwork of the carbonising plant by alkali attack has caused attention to be concentrated upon the application of the soda to the coke rather than to the coal. Difficulties in distribution of the alkali throughout the coke have been avoided by treating the coke while hot, the cooling thereby induced causing the solution to be sucked into the pores. A suitable practical method is to quench the coke coming from the oven red hot with an alkali solution instead of with water. In this way 1 per cent. of alkali has been added to the coke on a practical scale.

The process has considerable importance to the chemical industry. Obviously, it is unnecessary to treat coke used in the metallurgical industries. Indeed, the process is not successful in lowering the combustibility of hard metallurgical coke to a sufficient extent for domestic uses. That leaves about 15 million tons of coke which might be treated with alkali. It may well be assumed that about 10 million tons would be treated if the process were generally adopted. That would mean an outlet for 100,000 to 2,00,000 tons of soda annually.

The difficulty at the moment is to discover the incentive to alkali activation. That, we feel, will come later, but if the carbonising industries are brought under national ownership, will the Ministry of Fuel and Power agree to adding half-a-crown to the cost of every ton of coke produced in order that it shall be more convenient to use? Certainly there are advantages in the process. Mr. Askey reports that "figures cannot adequately convey the general improvement in the appearance and liveliness of the fire brought about by alkali activation." On the scientific side, chemists will be interested in the explanation given of this peculiar action of soda on so intractable a material as coke. The explanation favoured is that given by H. S. Taylor and H. A. Neville (*J. Amer. Chem. Soc.*, *43*, 2055) as long ago as 1921, namely that "the catalytic activity of alkali carbonate is due to its power of facilitating the desorption of CO_2 from the surface of the carbon, so keeping the surface clean for fresh adsorption of gaseous reactants." But if this is true, why is the rate of reaction of coke with CO_2 (the normal measure of "reactivity") increased by alkali activation?

NOTES AND COMMENTS

A Minister's "Scoop"

A JOURNALIST may legitimately congratulate himself when he secures a "scoop." Even a technical journalist is not altogether free from that amiable weakness. We doubt, however, whether a Cabinet Minister ought to feel any satisfaction in "scooping" the Press. There is too great a tendency nowadays for important items of technical interest to be withheld from publication until some occasion when it suits an eminent Government spokesman to make an announcement. Was it really essential, for example, for news of the "L-Delay" fuse to be kept under cover until Mr. Morrison could announce it at the recent anniversary meeting of the British Non-Ferrous Metals Research Association? In war time there is every reason for withholding technical information until it can be released with safety; in peace time the news of any technological advance in British industry is a "selling point" for the exportable products of that industry, and the Government (quite rightly) never tires of telling British industry that it must sell, and sell, and go on selling, or else die. It is vital, therefore, that such news should be broadcast at the earliest opportunity and as widely as possible. Before the war it was the admirable custom of the National Physical Laboratory to open its portals to the technical Press. After six years of "security" it is time that more of our technical advances should be brought to the public notice in a similar manner. The best advertisement for British technology is straightforward reporting—not the production of rabbits out of a hat.

Quality Not Enough

THE importance of good designing in manufacture has been fostered for many years in this country by such bodies as the Design and Industries Association. The old-fashioned tendency to regard an article as adequate aesthetically so long as it was sufficiently decorative has been replaced by conscious designing, not only to make the product more effective in use, but to improve its appearance. There is still room for improvement, and an American visitor has done well to draw attention, in a letter to *The Times*, to this vital aspect of modern production in its relation to export. Stating that U.S. firms are fully alive to this factor, and believing that British and American interests are, in the long run, parallel, Mr. Raymond Loewy suggests that the high quality of English goods is often obscured by "an irritating colour scheme, or a disorganised appearance." At the same time, U.S. firms are increasingly aware of the need for quality which they have hitherto somewhat neglected, and it is thus more than ever vital for us to ensure that our products do not lack the good designing so widely found in America. One phrase in Mr. Loewy's letter would cause John Ruskin to turn in his grave. "The American conception of aesthetics," he writes, "consists of a beautiful sales curve shooting upwards"! Few British manufacturers will be satisfied with this definition, but it may at least stimulate them to recognise the need for better designing in the recovery of our export trade.

The Chemistry of Bracken

MODERN chemical research, coupled with the correct use of good chemical engineering practice, has vastly broadened the range of possible raw materials; and many substances, formerly regarded as little better than rubbish, are now being made to serve their turn as the basis of useful products. The science of chemurgy occupies itself with the chemical development of the fruits of the earth, and, taking these in their widest sense, we must not forget that the "fruits" include many plants which are normally regarded as pests. Consideration of one particular pest—bracken—has been taken in hand by that determined Scottish scientist, Mr. R. H. S. Robertson, and in *Bulletin No.* 6 of the Scottish Reconstruction Committee (*see Farming News*, October 19) he suggests that a full-time director of research of bracken should be appointed a member of a Scottish Raw Materials Research Association. Bracken (*Pteridium aquilinum*) is undoubtedly a pest, but

it has its virtues. Mr. Robertson points out that it was formerly used for packing cherries and apples, and is said to have kept them in excellent condition; it has been used also for keeping the soil clean around raspberries, and as a protection for rhubarb, celery, and so on. It is quite likely that these traditional uses may be due to the presence of some fungicidal or fungistatic substances. Little is known about the supposed poisonous constituent, which may be ricin—anyone who has chewed bracken fronds will recollect the "castor-oily" taste. The fronds were once used in medicine for their anthelmintic properties, and also as the basis for a magenta dye. The rhizomes were employed in brewing, and the ashes for making glass and soap, and as a fertiliser. Some chemical work has indeed been done on measuring the seasonal variation of the constituents of the fronds, but surprisingly little is known of the general biochemistry of *Pteridium*. Even though "aquilin" extracted from bracken may not eventually take the place of penicillin (as Mr. Robertson suggests in a prophetic fantasy of 1962 in the *New Scot*), there is plenty of scope here for research on the part of the biochemist and chemurgist.

A Professor's Prophecy

MANY and ominous have been the pronouncements and *obiter dicta* of various scientists concerning the future applications of atomic energy; some indeed have even threatened a technocracy, though their pretensions were forthrightly dealt with by Mr. Churchill in the House of Commons recently. It has been left to a professor of chemistry to make an outright prophecy on the subject. We are referring to the statement by Professor James Kendall, F.R.S., of the Chair of Chemistry at the University of Edinburgh, in an address on "The Future of Atomic Energy" delivered to the Edinburgh City Business Club at their luncheon the other day. Professor Kendall said outright that in his opinion atomic bombs would never be used again in any war. Would-be scoffers may be reminded that the same professor prophesied seven years ago that poison gas would not be used in the second Great War. His chemical colleagues—and no doubt other outspoken friends—told him he was "crazy"; we know now how right he was.

Atomic Energy in the Future

HIS first prophecy was based on the knowledge of the superior efficacy of high explosive and incendiary bombs; the present prediction stands on quite other grounds. It is the fact that there is no defence against the atomic bomb which gives rise to his belief that this weapon will not be used again. "Every large city on both sides," he says, "would be blown to pieces, and there would be no winner. Civilisation would be absolutely destroyed." We are indeed very dubious whether any nation would be so foolish as to make war, in the certain knowledge that it could not win. On the other hand, Professor Kendall expressed his certainty that atomic energy would come into practical use in the near future—first of all in conjunction with power plants, later in connection with large transport units. Anyone, of course, is at liberty to disagree with Professor Kendall, but his views have the advantage of being clear-cut—a great advantage beside the extremely woolly predections of certain persons who ought to know better.

Phthalic Esters Released

Large Stocks Available

THE Plastics Materials Division of the Ministry of Supply announces that, as Government demands have almost ceased, the dialkyl phthalates (dimethyl, diethyl, dibutyl, diamyl, dihexyl, and dioctyl) are now more freely available and, apart from direct exports, will not require licences as from November 19.

As a result, in combination with the recent release of diacetin, triacetin, and tricresyl phosphate, almost all important cellulose acetate, nitrocellulose and polyvinyl chloride, etc., plasticisers are now free from direct Ministry of Supply licensing. In conjunction with the above information, British Industrial Solvents, Ltd., report that during the last few years their capacity for the production of these plasticisers has been increased many times and provided raw material releases continue as at present, they will have no difficulty in meeting demands very much larger than before the war. For the convenience of the trade they have arranged for large stocks of the more important plasticisers to be available both in the North and in London.

Recent Developments in Analytical Chemistry—XVI

(from Our Analytical Correspondent)

THE critical examination of qualitative tests for ions, being carried out by Wenger and Duckert, continues with a review of existing methods for the detection of iron, both ferrous and ferric.[1] Reagents recommended for ferrous iron include 2 per cent. α : α dipyridyl in dilute hydrochloric acid, or 0.025 molar *o*-phenanthroline, both of which give a red colour, and may be applied as spot tests on plate or paper, or as ordinary test-tube reactions

Ferric iron may similarly be detected by 5 per cent. aqueous salicyl-5-sulphonic acid, which gives a violet colour; by saturated potassium thiocyanate, giving the well-known blood-red colour; by acetyl acetone, which gives a red colour; or by 10 per cent. barium *iso*nitrosothioglycollate in dilute hydrochloric acid, which gives a blue colour. In addition, ferric iron may be detected under the microscope by the red precipitate formed on treatment with saturated aqueous pyramidone/ammonium thiocyanate and 0.02 per cent. cobaltous chloride in 1 per cent. hydrochloric acid, on warming to 60° C.

Davidsohn[2] claims that when it is desired to estimate iron through precipitation as ferric hydroxide, it is possible to obtain a granular precipitate, easy to wash, if the process is carried out in boiling solution containing equal parts of alcohol and water. Otherwise treatment is similar to that applied in classical separations, except that washing liquid and precipitant are also made up with equal parts of alcohol and water.

Volumetric Estimation of Iron

An iodometric method of determining the iron in iron phytate is proposed by Foy and Thompson.[3] A hydrochloric acid solution of the material is treated with potassium iodide solution, allowed to stand for 5 minutes, diluted with water, and titrated against standard thiosulphate solution, using starch as indicator. The relative proportions of hydrochloric acid and potassium iodide should be carefully controlled to prevent precipitation of the phytate, but at the same time to keep the acid concentration as low as possible.

Ferrous and ferric iron can be simply estimated, in the presence of copper, by a process making use of copper reduction.[4] A portion of the solution is diluted and made acid with sulphuric acid. It is then titrated in normal fashion with 0.1 *N* potassium dichromate solution, using barium diphenylamine sulphonate as indicator. This gives the amount of ferrous iron. Subsequently, ferric iron is reduced to ferrous iron by addition of a slight excess of copper powder, shaking for 2 minutes, and filtration. A second titration gives the total iron in the solution.

Different rates of atmospheric oxidation in the presence of a trace of copper sulphate enable iron to be determined in the presence of chromium and titanium.[5] To the solution containing iron, chromium and titanium, and made acid with sulphuric acid, is added 0.0003 millimol of copper sulphate for every 300 ml. of solution. The solution is then passed through a Jones reductor. Subsequent aeration for 5 to 10 minutes converts chromium and titanium to the oxidised form, while leaving iron substantially in the ferrous form, so that it may then be titrated with permanganate solution. This method is not applicable in the presence of molybdenum and vanadium.

Two papers describe use of the silver reductor in iron estimations. Henry and Gelbach[6] pass the ferric solution through a reductor such as that described by Walden, Hammett and Edmonds,[7] at a rate of 30 ml. per minute. The solution is then made acid with phosphoric acid, and titrated with dichromate, using diphenylamine sulphonic acid as internal indicator. Such a method is not interfered with by manganese, chromium or titanium. However, if vanadium is present in a concentration greater than 100 mg. per 200 ml. of solution, it will interfere. The dichromate titration is preferred to a ceric sulphate titration because of the lower cost.

The micro-volumetric determination, using the silver reductor,[8] is not influenced by cost considerations in the same way. The reduced iron solution is therefore titrated against standard ceric sulphate solution in an atmosphere of carbon dioxide. For the titration a suitable vessel is described, and use is made of a modified Hadfield[9] microburette. Both *o*-phenanthroline/ferrous complex and α : α′-dipyridyl are stated to be suitable indicators. For the actual reduction of quantities of 0.1 to 1.0 mg. of iron in a final volume of solution of 5 ml., and for handling even smaller amounts, special reductors have been devised. As little as 0.03 mg. of iron has been determined by the method.

Colorimetric Methods for Iron

Many colorimetric procedures for the determination of iron have recently been reported. To determine small amounts in water the sample is first digested with much

hydrochloric acid, cooled, and oxidised by permanganate solution, and the blood-red colour with thiocyanate, which is stable in strong acid solution, is then developed.[10] The method is stated to be convenient since the colour is little affected by small variations in the concentration of the reagents, and unaffected by the presence of organic matter in the water.

Iron in Brasses

Up to 3 per cent. of iron has been determined in brasses and similar industrial alloys, by thiocyanate, using the photoelectric colorimeter.[11] The sample, in the form of drillings, is dissolved, by warming to not more than 40°C. in 50 per cent. sulphuric acid with 100-vol. hydrogen peroxide. Hydrochloric acid and oxalic acid (to remove the copper, and some of the nickel and zinc) are then added, and the solution is made up to 250 ml. Two hundred ml. of this solution are filtered, and 50 ml. are taken down to fuming with sulphuric-nitric acids, taken up in water, cooled, and made to known volume (say, 100 ml.). Ten ml. of this final solution are treated with permanganate to faint pink, decolorised with a drop of sulphurous acid, and then the thiocyanate colour is developed in the presence of hydrochloric acid and ammonium persulphate. A green filter is used to determine the absorptiometer reading, and the concentration of the iron is read from a calibration curve. For very small amounts of iron, of the order of 0.05 to 0.50 per cent., the absorptiometer is read, and a blank is then determined, the iron content corresponding to the difference between the two readings.

The same basic reagent has also been applied to the rapid determination of iron in unsintered metal carbides.[12] The procedure which is used can be extended to allow determination of cobalt and titanium also. The carbide is oxidised in a muffle, fused with sodium carbonate, and the tungsten is washed out with hot water. The residue is now ignited and fused with potassium bisulphate, the fused mass being dissolved in 30 per cent. sulphuric acid. A known fraction of this solution is used for the determination, and is treated with 5 ml. of a 20 per cent. potassium thiocyanate solution. The extinction values for the coloured solution and for a blank are measured within two hours, and the corrected result is read off against a calibration curve prepared from AnalaR iron salt solutions. Either ferric alum, or ferrous ammonium sulphate oxidised by permanganate, is satisfactory. Ferrous salts should not be oxidised by nitric acid. The values obtained by this method compare closely with those given by a gravimetric method applied as check.

Determination of iron in copper-base alloys may be made absorptiometrically, using sodium thiocyanate as the reagent for the development of colour.[13] The method has been arranged in such a way as to be capable of extension to include the determination of manganese. The sample is dissolved in mixed nitric-sulphuric acids, and an aliquot is treated with further nitric acid and ammonium persulphate. The colour is developed with 20 per cent. reagent. In a variant dscribed by Thompson[14] the iron-thiocyanate colour is extracted with *iso*-butyl alcohol. The alcohol is then dried with anhydrous sodium sulphate, and the colour measured. Potassium persulphate and hydrochloric acid are used to stabilise the colour. In this method it is essential that the relative proportions of solution and alcohol for extraction should be maintained constant, since the alcohol has a small but appreciable solubility in the water phase. It is recommended that if more than 50 μg. of iron are present, an aliquot should be used for the determination. When the iron-thiocyanate colour is developed in the presence of cobalt, the absorption band for the colour produced with the cobalt ion overlaps that for the ferric complex to such an extent that a single colour filter is not sufficient to cut out interference by the cobalt.[15] When, however, two filters are used, for the regions round 525 and 425 mμ, results which are accurate for the iron within ± 3 per cent. are obtained, and the cobalt effect is eliminated. It is pointed out, however, that the presence of acetone makes the cobalt colour stronger, and should be avoided.

Miscellaneous Colorimetric Reagents

The absorptiometric determination of small amounts of iron, fitted into a schematic method which covers a number of other elements, has been described.[16] After appropriate separations, for which a scheme has been devised, the aqueous solution containing the iron is made acid with hydrochloric acid, and is treated with 10 per cent. thioglycollic acid, followed by ammonia. Using a blue-green filter, the absorption of the solution and of a blank are determined, and read off from a calibration curve prepared similarly from standard iron solutions. On a 2-g. organic sample, it is claimed that 0 to 50 parts per million of iron can be determined with a precision of ± 2 parts per million, while for 50 to 250 parts of iron the precision is ± 5 parts. The method is specific for iron under the conditions described.

Thioglycollic acid is also one of the reagents recommended for determination of iron in beer wort.[17] After a preliminary treatment of the wort to remove all but inorganic materials, the residue is made up so that 10 ml. of the solution correspond to 100 ml. of the original wort. An aliquot of the solution is treated with citric acid, and then with thioglycollic acid and ammonia,

to *p*H 9. The colour developed is compared with standards which contain sufficient of a potassium dihydrogen phosphate/calcium sulphate/magnesium sulphate/sodium chloride solution to simulate the salt content of the unknown. Any precipitate which forms is probably magnesium ammonium phosphate, and may be removed by centrifuging. Alternatively, the solution may be made ammoniacal, diluted, acidified with nitric acid, and treated in a Nessler glass with potassium ferrocyanide solution, using similarly treated standards.

Iron may also be determined absorptiometrically, using *o*-phenanthroline as reagent.[18] The solution is treated with 1 ml. of 1 per cent. hydroquinone and 2 ml. of 0.25 per cent. *o*-phenanthroline, and sodium citrate is then added to buffer the solution to *p*H 3.5. The colour is read, and corrected by that of a blank, being converted to iron content from a calibration curve based on standard iron solutions. The colour development is appreciably influenced by the order of addition of the reagents, by the time elapsing between additions and the time allowed for development, by the temperature of the solution, and by other factors. The temperature should be maintained above 20° C., and the colour should be allowed to develop for 30 minutes.

A method of determining total iron, which has been applied to processes where radioactive iron has been used, employs α : α'-dipyridyl as reagent.[19] The iron in solution is reduced to the ferrous form, buffered to *p*H 5.4 with a sodium acetate/acetic acid buffer, and treated with 0.2 per cent. reagent in 10 per cent. acetic acid. The transmission is measured, using a 500-560 mμ filter, and is read on a calibration curve.

Nitroso-R salt is yet another absorptiometric reagent for iron.[20] Ten ml. of the solution are treated with 0.5 ml. of a 10 per cent. solution of hydroxylamine sulphate, and then with ammonia until the colour with metanil yellow indicator is pinkish-yellow. The whole is treated with 1 ml. of a 0.5 per cent. solution of the reagent, and is buffered with 2 ml. of a 4 *N* sodium acetate solution. The transmission is measured with a 640-700 mμ filter.

Suggested New Reagent

As a new reagent for this purpose, Yoe and Jones[21] propose disodium-1 : 2-dihydroxybenzene-3 : 5-disulphonate, which, at *p*H 9-10 (obtained by the use of disodium phosphate/sodium hydroxide), gives a red colour with as little as 1 part of iron in 200,000,000. If the *p*H is adjusted, by sodium acetate/hydrochloric acid, to 3.5-4.5, the colour is blue, in concentrations down to 1 part in 30,000,000. The solution is buffered to whichever range is desired, and the colour is then developed in a Nessler glass and compared with similarly prepared standards. Not more than 1 mg. of iron should be present. Few ions out of 78 tested interfere, and the determination is possible in the presence of fluorides, phosphates, tartrates, citrates, oxalates, etc. The reagent is stable in aqueous solution, as are the colours produced, after 18 hours. Finally, mention should be made of the spectrographic estimation of minute amounts of iron in samples of 1 to 12 mg.[22] The material is photographed in mixture with specially pure nickel oxide, the iron being treated as an impurity in the oxide and so determined.

Detection of Sodium

When one drop of a 0.5 per cent. solution of picrolonic acid in 50 per cent. alcohol is applied, as a microscope-slide test, to material containing sodium, and the whole drop of material is crystallised and allowed to dry, sodium picrolonate can be readily distinguished from the corresponding potassium salt under the polarising microscope.[24] In outward appearance the two salts are similar, giving rod-shaped crystals and needles. The sodium salt, however, shows parallel extinction, while n_α, the most commonly occurring refractive index, is 1.616. On the other hand, the potassium salt shows oblique extinction, and n_α is 1.505. The commonest refractive shown in this case is actually 1.519. Before carrying out this test, all other cations should be removed, since a number of other crystalline picrolonates which interfere may be formed.[24]

The method of determining sodium in aluminium, as first proposed by Scheuer[25], by heating at 900° C., thus obtaining the sodium as oxide on the surface of the metal, whence it can be extracted and titrated with acid, has been criticised because of incompleteness of extraction, and also because of interference from magnesium. Osborn[26] has devised a procedure to overcome these drawbacks in aluminium-magnesium alloys. He first heats the alloy, in the form of turnings, in an electric muffle at 650-670° C. for 1 hour. The turnings are then extracted with water, and the filtrate is evaporated to small bulk. Any precipitated magnesium hydroxide is filtered off, excess of 0.01 *N* hydrochloric acid is added, and the solution is back-titrated with 0.01 *N* sodium hydroxide solution, using phenol red as indicator.

According to Smart,[27] aluminium alloys containing small amounts of sodium may be dissolved in amyl alcohol, under reflux, in the presence of a small amount of mercuric chloride, and then treated with water to precipitate aluminium hydroxide. The filtrate is taken to dryness, and extracted with a few ml. of hot water. This extract, treated with zinc uranyl acetate solution, is kept at 20° C. for half an hour in a water bath, filtered through a G3 or X3 glass sinter, washed with reagent, then with alco-

hol saturated with sodium salt of the reagent, and finally with dry ether. A blank on the reagents should be carried out. The method is claimed to be rapid and reliable.

As an alternative to this method, he proposes dissolving the alloy in hydrochloric acid, cooling in ice-water, and salting out the aluminium as the chloride, with hydrogen chloride. The chloride is filtered off and washed with ice-cold hydrochloric acid saturated with the gas. The filtrate is taken to dryness, extracted with boiling water, and the remainder of the aluminium and other impurities are precipitated with ammonium sulphide. Ammonium salts and any sulphuric acid which may have formed are then removed, and the residue is dissolved in small bulk, precipitated with zinc uranyl acetate, and estimated as already described. This method usually gives a high blank, and is therefore not very suitable for low sodium content.

Molybdenum, if present, interferes with the determination of sodium by zinc uranyl acetate, since molybdate gives a yellow precipitate, possibly uranyl molybdate, UO_2-MoO_4, with the reagent. However, it is claimed[28] that if molybdate is converted to a complex with tartaric or citric acids, no such precipiptate forms, and sodium may be estimated satisfactorily.

Magnesium uranyl acetate has been applied to the determination of sodium in potassium hydroxide.[29] One g. of sample is dissolved up and treated with perchloric acid till considerable excess is present. The whole is fumed down, allowed to cool, and the precipitate of potassium perchlorate is extracted four times with 5-ml. portions of *iso*propyl alcohol. The alcoholic extract is treated with magnesium uranyl acetate solution, allowed to cool for ten minutes, filtered, washed with not more than 25 ml. of *iso*propyl alcohol in small portions, dried at 105-110°C., and weighed. A correction factor of 0.94 is used to allow for loss in the determination.

Sodium in Silicates

In the determination of sodium in silicates, the sample, such as a clay, is first carefully decomposed with 4 ml. of 50 per cent. sulphuric acid and 8-10 ml. of hydrofluoric acid, in such a way as to avoid loss by spitting.[30] The whole is taken to dryness, and again fumed down with 2 ml. of the sulphuric acid. The residue is heated very strongly (900°C.), the temperature being raised to this point very slowly over a period of 20 minutes, and the final heating occupying a further ten minutes. By this treatment, aluminium and titanium are rendered completely insoluble. The residue is extracted twice with hot water, and the extract made up to 100 ml. Fifty ml. of this solution are used for the sodium estimation. If much calcium is thought to be present, sulphate is first precipitated with barium chloride solution in slight excess, and the filtrate is evaporated to dryness on the water bath. If calcium has not been suspected, the appearance of needle crystals after evaporation will indicate the necessity for its removal. Sodium is determined by precipitation as sodium magnesium uranyl acetate, filtered on a G3 or X3 sintered glass filter, washed with alcohol and ether, dried at 105°C., and weighed.

Miscellaneous Sodium Methods

Sodium is determined in blood or serum by a volumetric procedure.[31] Proteins are first removed from the diluted medium by trichloracetic acid, the filtrate is concentrated to small bulk, and sodium is precipitated by the use of zinc uranyl acetate reagent, avoiding the use of excess alcohol, which may also precipitate some of the reagent. The precipitated solution is allowed to stand at room temperature for an hour, is filtered through a G3 or X3 sinter, and the precipitate is washed four times with small amounts of freshly distilled alcohol saturated with the sodium triple salt. The precipitate is then dissolved by washing with five successive portions of water (a total of 5 ml. suffices for an original amount of 0.2 ml. of blood or serum). The solution is titrated against 0.1 *N* sodium hydroxide, using a 5-ml. microburette and phenolphthalein as indicator. The titration is corrected by a blank determination.

A procedure for sodium, whereby the triple acetate is precipitated, and developed with excess of ammonium carbonate and hydrogen peroxide, the uranium being then determined colorimetrically, has been described by Arnold and Pray.[32] The polarograph has been found satisfactory for very small amounts of sodium in biological material[33] or in aluminium alloys.[34] In the latter case, the results obtained have been used as a check, in the lowest ranges, on results obtained spectrographically, and have agreed satisfactorily over the range 0.001 to 0.01 per cent. Interference of the aluminium is prevented by converting it to a tetramethyl ammonium complex. Caley and Rogers,[35] investigating the action of copper uranyl acetate as a precipitant for sodium, have decided that, although not satisfactory in aqueous solution, it can be used to advantage in ethanol solution.

Spectrographic Methods

Sodium, along with the other alkalis, can be determined in Portland cement by a spectrographic procedure.[36] A mixture of the sample is made with three times its weight of a "buffer" composed of 60 parts silica, 14 parts alumina, 20 parts calcium carbonate, and 6 parts lithium carbonate. One-third the sample weight of pure silver oxide is added. Using a d.c. arc, the near infra-

red spectrum is photographed, and comparison of the intensities of the lines for sodium (at 8195 Å) and silver (at 8274 Å) gives, from calibration curves, prepared from cements of known sodium content, a value ± 4 per cent. of the true value, between the limits 0.05 to 1 per cent. of total concentration.

Traces of sodium can also be estimated spectrographically in aluminium alloys.[37] The electrodes are rods of the sample, 4.5 mm. in diameter, which give an interrupted arc. The amount of sodium is estimated from the comparative intensities of the sodium line at 5890 Å. and an aluminium band head at 4842 Å. Sodium present in as low as 0.0005 per cent. concentration can be determined.

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Columbite was an important product of Nigeria during the war, as the source of ferro-columbium for the metallurgical industry. Out of a total production in 1944 of 2072 tons of the material, 1000 tons were recovered by re-treating the Nigerian alluvial tin-mining dumps, according to Dr. F. Dixey, director of the Geological Survey of Nigeria.

More Research Fellowships

Turner and Newall's Gift

THE directors of Turner & Newall, Ltd., in recognition of their belief that to an increasing extent universities and industry are mutually dependent, have decided to give the necessary funds to provide eight Research Fellowships in engineering, inorganic chemistry, or physics —or allied sciences—such Fellowships to be financed by them for a period of seven years, and to be established at specified universities in areas in which the company has certain of its larger factories. The Fellowships will be known as "Turner & Newall Research Fellowships."

Manchester University will have four such Fellowships, the University of London two, Leeds University one, and the University of Durham one. The Fellowships will have a normal value of £600 per annum each, and the universities will accordingly receive a total sum of £33,600 over the seven years' period.

New Leeds Laboratory

Donation by Mr. C. Brotherton

TO establish a laboratory in chemical engineering, Leeds University has received a gift of £50,000 under covenant over the next ten years from Mr. Charles Brotherton, president of the Yorkshire chemical engineering firm of Brotherton & Co., it was announced at last week's meeting of the University Council. In addition, Mr. Brotherton makes an immediate gift of £5000 for the same purpose.

Dr. J. S. Forsyth, at present Brotherton Research Assistant in Chemical Engineering, has been appointed Brotherton Lecturer in this subject.

Other Leeds Developments

Other gifts to the University acknowledged by the Council at last week's meeting include a further grant of £1500 from Courtaulds, Ltd., for investigations in the textile and dyeing departments, and continuing gifts in money and in kind from Roche Products, Ltd., for investigations in the biochemical laboratories.

It was announced that post-war developments include a building to house the Departments of Fuel and Gas Industries, Chemical Engineering, and Metallurgy. It is understood that one of the floors of this building will be devoted to the Brotherton Laboratory.

Two new companies, Quimica Fabril, S.A., and the Laboratorio y Comercial Hermes, S.A., have recently been established in Barcelona, with a capital of 1 million pesos each.

Parliamentary Topics

University Laboratories

IN the House of Commons last week, Mr. Cobb asked the Financial Secretary to the Treasury how many university laboratories in England and Wales had been destroyed or damaged by enemy action; how many of these had been rebuilt or repaired; and how many had been re-equipped.

Mr. Glenvil Hall: University premises, including laboratories, suffered serious war damage at six colleges and schools of the University of London and at the Universities of Bristol, Liverpool, and Manchester. No permanent rebuilding has yet taken place, but a considerable amount of temporary repair work has been, or is being, carried out. I have no detailed information as to the extent to which destroyed equipment has been replaced.

Scottish Terra-cotta Clay

Major McCallum asked the Secretary of State for Scotland whether he was aware that there was a large area of terra-cotta clay situated on the southern shores of Loch Creran, near Shian Ferry; and if he would refer the matter to the Scottish Council on Industry.

Mr. Fraser: The Building Materials Committee of the Scottish Council on Industry is at present engaged, in co-operation with the Geological Survey, on a comprehensive investigation of brick clay deposits in Scotland with a view to the expansion of the brickmaking industry.

German Reparations

Mr. Horabin asked the Chancellor of the Duchy of Lancaster on what basis the peacetime industrial production of Germany would be assessed in order to arrive at the plant and machinery to be removed from the British zone as reparations; and how far the needs of the European economy for the products of German industry would be taken into account.

Chancellor of the Duchy of Lancaster: These matters are under examination by a Level of Industry Committee set up in Berlin by the Allied Control Council. Broadly, the peacetime production of Germany should be restricted to what is necessary to maintain a living standard not above the average of other European countries and industries useful for war purposes should be reduced to the minimum consistent with approved peacetime requirements. A considerable proportion of German heavy industry will not be destroyed, but transferred to allied countries who own industries have been damaged in the war. German imports, to maintain her approved standard of living, would have to be paid for by exports which would contribute to the needs of European economy as a whole.

Instrument Technology

Scottish Section Inaugurated

AT the inaugural meeting of the Scottish Section of the Society of Instrument Technology, held recently at the Royal Technical College, Glasgow, the chairman of the Section, Professor W. M. Cumming, introduced the president of the Society, Sir G. P. Thomson, F.R.S. In welcoming the president, he wished to take the opportunity of honouring him for his personal abilities and his contributions to the world of physics, also for his services to the Allied cause.

In his address, the president gave an outline of the progress of the Society since its inception some two years ago. He described how a number of persons representative of the various branches of instrument technology throughout the country met to discuss the formation of a society which would co-ordinate information regarding the use, application and maintenance of instruments, provide opportunities for technical research, encourage facilities for education and generally develop a status for those engaged in the industry. In these days the need was even greater than before the war for such an organisation. He thought it was advantageous that a section should have been formed so soon after the formation of the parent body, and he was certain that every encouragement would be given by London.

At the request of the chairman, Sir George made reference to recent work in connection with the use of atomic energy, pointing out that in the near future the tendency would be towards large plants which might generate something in the region of 50,000 or 100,000 h.p., but that the greatest difficulty would be found in making anything which would drive a motor bicycle or even an aeroplane.

FUEL PRICES DECREASE

With the aim of giving all possible assistance to industrial recovery, the Minister of Fuel and Power announced on November 21 that, after consultation with the Petroleum Board, he had approved the following decreases in the price of fuels:

Diesel oil for road vehicles, paraffin, vaporising oil, white spirit, gas oil, diesel oil (other than for road vehicles), fuel oil and heavy fuel oil (inland trade schedule): decrease of ¼d. per gallon.

Creosote-pitch mixture: decrease of 16s. per ton.

Bitumen: decrease of £1 10s. per ton.

In addition, petrol will be ¼d. per gallon cheaper in England, Wales, and South Scotland, thus bringing the price of pool spirit in those areas down to 1s. 7½d wholesale, and 1s. 11d. retail.

Metallurgical Section

Published the first Saturday in the month

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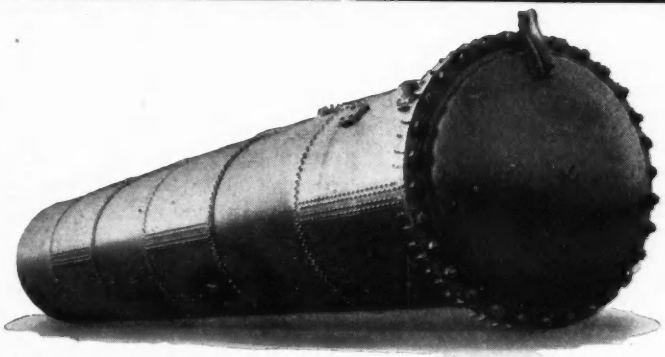

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Metallurgical Section

December 1, 1945

Conserving and Reclaiming Mercury

Modern Industrial Practice

by A. G. AREND

THE need for economising in mercury has become more acute of recent years in view of the ever-expanding uses to which this metal is put, accompanied by the fact that natural reserves appear to be being slowly but surely worked out. The early exhaustion of deposits which contain mercury has always been a source of worry, but has to a large extent been compensated for by the finding of fresh ones. Up to the beginning of the war, mercury was chiefly utilised in the cyanide treatment of gold and other ores by the familiar amalgamation method, for alkali chlorine cells, thermometer and other instrument production, looking-glasses, fulminates, pharmaceutical preparations, and for odd electro-plating purposes.

Some Early Processes

As regards the salts, many of the earlier processes which consumed these endeavoured where possible to substitute less costly reagents, but some of them are still required for certain felt, tanning, paint, sealing wax, textile, and photographic uses. Among the systems where the use of the metal was abandoned are the production of black finishes on iron and steel, reclamation of vanadium and molybdenum from discard metal, and firework preparations. On the other hand, with the increased expansion in the uses of fluorescent and other mercury vapour lamps, besides electronic tubes and improved electrical equipment during the war, mercury is in still greater demand.

This year has seen the development of atomic power in which mercury has already been proposed as a source for harnessing for industrial purposes. The uranium product which has attracted so much public attention has evidently given difficulties in controlling it within known limits, even with the assistance of deuterium oxide and other methods. According to Paul Lucas, the atoms of mercury lend themselves more favourably to harnessing, although a scrutiny of his earlier patent protecting a mercury, steel filing, and graphite magnetisable liquid (U.S.P. No. 2,149,782) gives little indication of how this is to be applied. Whatever developments this may hold for the future, besides recent research with mercury vapour power plants, and mercury turbines, the primary feature is to ensure the maximum reclamation and conservation of the metal itself.

Conservation in Lamp Production

In order to implement this desired economy, one instance of making fluorescent lamps has already revealed that mercury consumption can be reduced by 50 per cent. and yet give a better product. The same system is expected to be applied to other electronic tubes likewise. Fluorescent light is produced by the action of ultra-violet rays emitted by electrically excited mercury atoms on fluorescent materials. By the earlier method, which is still in use for manufacturing various fluorescent lamps, free mercury was dropped into the lamp during the exhaust process by means of a mercury-dispensing device. This in itself was an improvement on still earlier systems in that it could be applied automatically.

There were, nevertheless, three important disadvantages: (a) the exacting accuracy of addition could not be assured so that the best performance of the lamp would accrue; (b) there were direct losses of mercury; and (c) the contamination of the dispensing sections (a tendency always evident) could result in still further losses. The number of rejected lamps was quite appreciable, and apart from this, efforts at reclaiming such small quantities of mercury at a time were regarded as wellnigh impossible.

Such rejection was due to one of two reasons; either the lamps faded out in a matter of a few hours, since too little mercury had been applied; or, alternatively, where too much mercury was accorded, the lamps showed serious dark end-discoloration, while heavy streaks and shadows also appeared. During the war the system was evolved of exploding a "mercury bomb" within the interior of the lamp, whereby only the exact amount of mercury is ejected in each instance, thus eliminating all previous wastes, and at the same time preventing the accumulation of the former rejects. A metal tube of almost infinitesimal size containing this exact mercury addition

is connected to a support lead of one cathode, and let into the lamp in this manner. During the exhaust process, when the current is first turned on in the lamp, the heat causes the mercury to expand and explode this tube, whereby free mercury is released and dispersed. In the making of these very fine mercury tube containers, as so much depends on this exacting addition, the production line is equipped with a selector device which automatically ejects any units that do not hold the correct mercury proportion. While this system has so far been engaged only in lamp production, it is expected that the same method of economising mercury may be applied in the making of other devices.

Speeding-up Waste Recovery

In instrument works, where mercury is utilised to some extent, reclamation of the metal can be carried to a modified extent by simply collecting all odd globules of the metal, purifying them by revolving in a paper-lined drum, and then subjecting them to dilute acid washing.

Where such accumulations become considerable, as in large instrument factories, too much time would be occupied in this way, and for this reason all broken glass, amalgamated sections, and residual matter containing mercury is put together in a small distillation hearth of the rotary type and fired by fuel-oil. Mercury is distilled and purified by a modification of large-scale recovery methods in which charges of from 2 to 3 cwt. are handled at a time, and details of these have already appeared.

An alternative process has recently been introduced wherein mercury is first cleaned as far as possible from all waste accumulations by acid washing, etc., and then simply distilled in strong glass vacuum stills which thus return the bulk of the metal. It should be made clear that the direct distillation method can accommodate all classes of materials, whereas this latter system is limited to actual metallic mercury wastes. When a very fine deposit of mercury remains in glass instrument parts, the acid is depended upon to ensure good reclamation, whereas with the direct modified distillation method, the heat ensures a complete recovery.

It has to be remembered that in all methods wherein nitric acid is utilised as a solvent for metals, the quantity consumed is considerable, and unless provisions are made for recovery of the nitric oxides, such methods are apt to be unduly costly. As it is, however, for small-scale recovery, an earthenware piggin of some 10 gallons capacity can be filled up with as much broken glass and instrument sections as possible, and the contents can be left digesting in the cold in dilute nitric acid as used for pickling purposes. To electrolyse a nitric acid solution of the kind means that the moment the current is turned off, part of the cathodic deposit of mercury will redissolve, in the same manner as does copper in nitric acid electrolytes.

Treating Ores

Most of the electrolytic processes for mercury relate to dealing with solutions other than those of nitric acid, and are really for treating cinnabar and other mercury-bearing ores, taking advantage of their solubility in alkaline sulphide solutions, etc. In actual practice, these methods are dirty, much sulphur tends to be deposited, the electrolyte is rarely clear and transparent, and the mercury, as recovered, requires much subsequent cleaning. Recently an improvement has been introduced by the substitution of

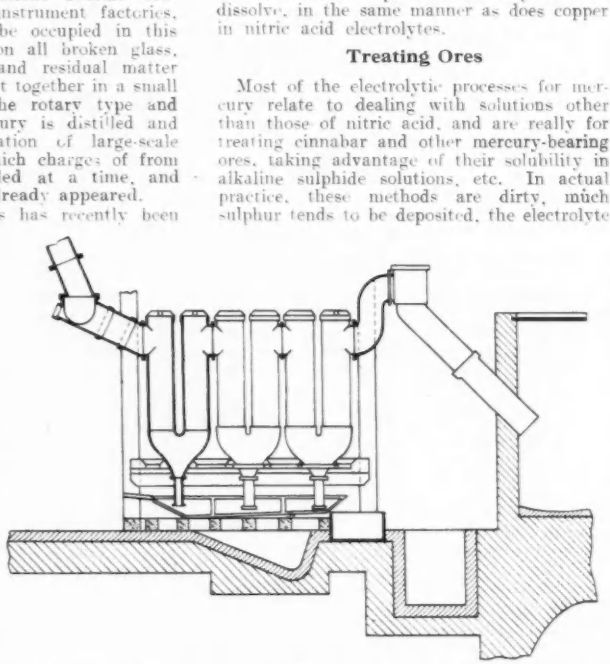

Fig. 1. Nearly all the earlier reclamation work was concerned with improving the methods of condensation, and the figure shows one of the ceramic condensing arrangements employed.

sodium chloride/hydrochloric acid electrolytes. With the development of the nitric acid process, 1 gallon of waste acid washings was found to require 4-6 amps. at 8-10 volts, which means that the process is somewhat slow, and a reference was made in 1942 that the recovery of 1 lb. of mercury occupied as long as 2-3 days. In order to accelerate output, alternating current was superposed in series, at frequencies of less than 10 cycles.

Advantages of the Improvements

As a result of this improvement, instead of having to await the slow electrolysis of the metal by direct current alone, a continuous small stream of mercury nitrate can be run into the bath. Liberties of this kind could not be taken where current efficiency was of paramount importance, *i.e.*, where large amounts of current were consumed, but in the foregoing system an efficiency of from 60 to 65 per cent. is about as much as can be expected in any case, and the extra addition of the superposed alternating current for small-scale reclamation work is of relatively little importance. In view of the small current applied, *i.e.*, 4-6 amps., provision is not made for the presence of silver, which in ordinary circumstances will be deposited along with the mercury, and when this impurity appears the system has to be altered to suit, although the majority of parts treated are free from silver. A small glass electrolysis bath suffices, which, by means of a controlled siphon tap, allows the quantity of electrolyte to increase as the process proceeds. This means that the concentration of salts in the electrolyte is continually changing, but this does not upset the process.

Metallic Mercury Cathode

The anode comprises a platinum wire gauze arrangement while metallic mercury, filled into the bottom as an even layer, represents the cathode. While with the previous direct current process, 1 lb. of mercury required an expenditure of about 2 kWh for recovery, the addition of the alternating current almost doubles this figure, but part of the recovered mercury can be siphoned off while operations are proceeding, and provided that a sufficiency remains to maintain a covering for the bottom of the bath, the electrolysis proceeds unhampered. Circulation brings the finally dilute electrolyte into contact between the platinum anode and mercury cathode. With the completion of the process, which is continued until an analytical test confirms that no mercury remains in the electrolyte, the siphon is again engaged to run off the whole of the mercury, *i.e.*, while the current is still on. The electrolysis bath is preferably used under some form of canopy to draw off the gases disengaged.

The electrical equipment comprises a small copper oxide rectifier for converting the alternating current from the mains to direct current, while, for the superposed current, part of it is linked up to a variable frequency alternator, with meter to check the desired maximum 10 cycles required.

The Mercury Turbine

In conclusion, some reference to recent developments in the use of mercury may not be amiss in view of the care which is now understood to be bestowed on its reclamation and conservation. With the mercury-vapour power plant, when steam is made to pass through, the fuel required for production of this steam averages only about

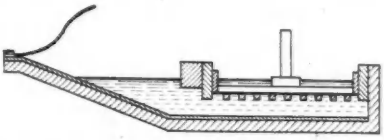

Fig. 2. Apparatus used to-day for recovering mercury from by-product solutions comprises an electrolytic bath in which a layer of mercury serves as cathode, while alternating current is superposed at low-frequency to speed up operations.

15 per cent. more than when it is produced in ordinary boilers. The power added by the mercury turbines, however, may be 75 per cent. or more of that produced by the steam, though these ratios are, of course, governed by the pressures of the steam and mercury used.

A detailed account of the apparatus was given by Emmet in a paper read to the American Society of Mechanical Engineers in 1942 to which reference should be made. The boiler described was designed to make 110,000 lb. of mercury vapour per hour, at about 100 lb./sq. in. pressure with walls covered by 126 tubes. Mercury turbines are equipped with barometric seals, vacuum connections, mercury throttles, and safety valves, and despite the comparatively large amount of mercury used, they are claimed to give an almost unbroken return of all mercury. This upholds the modern tendency to get as much out of this liquid metal as possible, while still assuring its complete conservation.

Statistics have also been published, showing the smallness of the losses sustained by large users, such as the cyanide amalgamation and Hooker-type alkali-chlorine cell processes. Considering that more than half the world's mercury hails from the still unsettled portions of Central Europe, the same rigid control deserves to be devoted to all other industrial uses of the metal.

Almin, Limited

New Light Metal Enterprise

THE incorporation of Almin, Ltd. (*i.e.*, Associated Light Metal Industries) is a major step in the plans of Colonel W. C. Devereux for the scientific development and extended application of light metals and their alloys. The new company, of which Colonel Devereux is managing director, has a capital of £2,000,000. Through subsidiary or associated companies, it will co-ordinate the financial and commercial policy of a group of undertakings, including International Alloys, Ltd., with its subsidiary, Light Alloy Products Co. (B'ham), Ltd. Renfrew Foundries, Ltd. (which is owned jointly by Rolls-Royce, Ltd., and Almin, Ltd.), and Warwick Aviation, Ltd., which will continue to be managed by its founder, Mr. L. E. Metcalfe.

The formation of two other major units remains to be completed. One of these will be for the production of light alloy forgings and extrusions. The other is the Research Institute. This is a feature of the new organisation which is unique in many respects. It will consist of an independent scientific research organisation on whose services will be available, not only to Almin and its associated companies, but to any other companies wishing to avail themselves of its resources for research in the metallurgical and allied fields.

It may be some time before the research laboratories are working at full strength, since the scientists for this work must be most carefully chosen if the high standards which have been laid down are to be achieved. A start has been made, however, by the acquisition of a large country house, which, standing in extensive grounds in a secluded yet readily accessible situation in the Home Counties, is believed to be ideal for the purpose. The task of collecting the latest and best apparatus for the equipment of the laboratories is also under way.

Colonel Devereux's pioneer work in industrial research is well known and the arrangements which he has made for this Research Institute represent his conception of the ideal application of industrial research—a conception based on many years' close study of the subject while in charge of companies operating some of the largest research laboratories in the country.

Renfrew Foundries

A recently-issued descriptive note deals with the great aluminium alloy foundries at Hillington, Glasgow, which have been acquired by Renfrew Foundries, Ltd.

During the war these foundries employed over 4000 workers who produced 31,440 tons of castings for 78,952 Rolls Royce engines of famous R.A.F. types. Now they will turn their great resources to the production of a far wider range of civilian products. Their work will be backed up by important associated facilities. Arrangements have been concluded for sufficient supplies of high-quality raw material, and strong teams of research scientists, designers, and engineers of the widest experience will be available. Unique facilities also exist for the production of prototype castings, thus reducing to a minimum the time lag between receipt of designs and the production of castings. The staff, which did such magnificent work during the war, will continue with the new company.

Plating on Aluminium

Industrial Process Developed

FOR many years the problem of successfully electro-plating aluminium has been one that has, to a great extent, baffled chemists both here and in the United States. Processes evolved have either been partially successful in dealing with large output or completely successful on individual items, but never, so far, successful in both.

A London firm, A.E.R. (1938), Ltd., has now evolved what is claimed to be a completely successful process for the electrical deposition of metal upon aluminium; and among those platings that can now be supplied are lead, iron, copper, tin, silver (matt or polished), cadmium, zinc, gold, brass, nickel (dull or polished), copper (polished and lacquired), and zinc (passivated).

This development means that aluminium can now be put to industrial and other uses in circumstances and situations where previously its application was not possible. Chemical works, for example, will find many applications for lead-coated aluminium, while the fact that silver can now be effectively plated on aluminium as well as zinc (passivated) allows the electronic industries to make a wide use of this metal in equipment where light weight is an essential prerequisite, and in tropical situations. Samples and data are available from the inventors of the process, A.E.R. (1938), Ltd., 120 Green Lanes, London, N.13.

A member company of the U.S. Aluminium Association reports that the number of uses for aluminium has now grown to approximately 3500, against some 2000 known uses before the war. Besides transport, which normally takes about one-third of the aluminium produced in the United States, the survey disclosed that the 3500 uses include many new applications in the oil industry, precision instrument manufacture, and the chemical and rubber industries.

Institution of Metallurgists

Inaugural Meeting

AT a widely representative meeting in London on November 28 it was announced that a professional institution for metallurgists had been formed. Dr. Harold Moore, C.B.E., the president, who for many years was director of metallurgical research at the Armament Research Department, Woolwich, and later director of research for the British Non-Ferrous Metals Research Association, said that while metallurgy was one of the oldest of the arts, it was one of the youngest of the sciences. Metallurgists were well served with learned and technical societies, but there was no organisation that could represent their common interests, express their corporate views, or give the hallmark of a recognised professional qualification in metallurgy. There had for long been a widespread desire for a new organisation admitting only qualified metallurgists and having functions supplementary to, but independent of, those of existing institutes.

The Institution of Metallurgists had therefore been incorporated, with the active help of the Iron and Steel Institute and the Institute of Metals. The provisional council had already drafted regulations for admission by examination and otherwise to three grades, Fellows, Associates and Licentiates. "It is the intention," said Dr. Moore, "that the Institution, by setting high standards of competence, shall serve the public interest and make an important contribution to industrial efficiency. Possession of the Institution's qualifications will be evidence of capacity to undertake responsible work as a metallurgist."

Primarily, the Institution will bring within one professional body qualified metallurgists engaged in production, research, teaching, consulting work, inspection and other metallurgical activities associated with any branch of industry. It will promote the welfare of the profession, improve and maintain its standing, and co-operate with all organisations seeking to advance the study of metallurgy. It will expect a high standard of professional conduct among metallurgists, promote better education and training, and will operate an appointments register. It will not in any sense act as a trade union.

Grades of Membership

The intention of the examination syllabus is that there shall be ample opportunity for metallurgists to proceed right through the various grades to the full Fellowship according as they can produce evidence of the requisite qualifications and experience. National Certificates in Metallurgy, diplomas granted by various colleges, and university degrees will all be taken into consideration. A Licentiate must be not less than 21 years of age, have had two years' practical experience and have passed the Institution's examination (of approximately university pass degree standard), or provided evidence of a similar level of knowledge. Candidates for admission without taking the Institution's examination have a wide choice of conditions as regards combinations of evidence of theoretical knowledge and practical experience. This is true also of the higher grades, which are full professional qualifications, the Associateship (minimum age 25) and Fellowship (35). A good honours degree, with the necessary practical experience, will normally admit to the Associateship, but the Council will exercise a wide discretion in assessing the qualifications of candidates for each grade of membership, and will give full weight to good work, of all types in any branch of metallurgy.

The subscription rates are for Fellows £3 3s., for Associates £2 2s., and for Licentiates £1 5s., with reciprocal reduction for joint members with the Iron and Steel Institute and the Institute of Metals to £2 12s. 6d., £1 11s. 6d., and £1 1s. 0d. respectively. No entrance fee will be charged for the time being. The first council, necessarily gathered together by nomination and co-option, is a representative selection of prominent metallurgists who will, however, retire at the annual general meeting of 1946. Adequate liaison with the Iron and Steel Institute and the Institute of Metals is provided by the joint use of 4 Grosvenor Gardens as headquarters, and the services of Mr. K. Headlam-Morley as secretary. The first council is constituted as under.

The First Council

President: Harold Moore, C.B.E., D.Sc., Ph.D., F.R.I.C., F.Inst.P. *Vice-presidents*: J. H. Andrew, D.Sc., G. Wesley Austin, O.B.E., M.Sc., Maurice Cook, D.Sc., Ph.D., W. T. Griffiths, D.Sc., F.R.I.C., F.Inst.P., J. W. Jenkin, Ph.D., B.Sc., A.R.I.C., C. J. Smithells, D.Sc. *Hon. treasurer*: Richard Seligman, Ph.nat.D. *Members*: W. E. Atkins, D.Sc., G. L. Bailey, M.Sc., W. Barr, W. F. Brazener, H. H. Burton, E. W. Colbeck, M.A., W. J. Dawson, E. Gregory, Ph.D., M.Sc., F.R.I.C., Roosevelt Griffiths, M.Sc., R. A. Hacking, M.Sc., J. L. Haughton D.Sc., F.Inst.P., J. E. Hurst, D.Met., J. Sinclair Kerr, R. Mather, B.Met., James Mitchell, A. J. Murphy, M.Sc., H. O'Neill, D.Sc., M.Met., H. Sutton, D.Sc., F. C. Thompson, D.Met., B.Sc.

German Tool Steels

Report on War-Time Manufacturing Practice

ACCORDING to a report on the German tool and special steel industry prepared by the U.S. Department of Commerce, five companies marketed practically all the tool and special steels used in Germany. Three of these companies were German, one Czechoslovakian and the fifth had a plant in Austria and another in Germany. The companies concerned were the Deutsche Edelstähle at Krefeld, Krupp at Essen, Röchling Stahlwerke at Wetzlar, and the Böhler Werkzeug Stähle, with their main plant at Kopfenberg in Austria and another plant at Düsseldorf. The Czechoslovakian company was the Poldi-Hütte at Kladno. Each of these five companies maintained between eight and twelve depôts in all the large industrial areas in Germany with complete stocks of sizes and grades.

Methods of Manufacture

As regards methods of manufacture, a striking similarity existed between these companies. They all manufactured their products in the form of rolled and forged bars, cold drawn and ground bars, wire, plated and finished. Practically all the steel was melted in electric furnaces, although each company had some open-hearth capacity for making carbon and low-alloy steels. The melting practice, the report continues, was similar to that used in the United States, highly alloyed steels, such as high-speed steel, being dead melted, but carbon and special steels, such as the ball-bearing type, being treated by the addition of approximately 1000 lb. of ore to a ten-ton charge. Two slags were used as a rule, though three were tried for some steels. Usually aluminium was used for deoxidisation, the average addition being 4 lb. per 10 ton. The ingot size varied greatly, apparently with the idea of casting the ingot as small as appeared to be consistent with the size of the bar to be manufactured; they varied from 300 lb. to about 8 tons. All ingots, regardless of composition, were annealed immediately after casting, the ingots apparently being kept at a comparatively high temperature until placed in the annealing furnaces. After the annealing, the ingots were rough turned. All highly alloyed steels with the exception of straight carbon steels were hammered, while steels of the S.A.E. type were pressed. Heating was by the use of coke-oven gas and nothing unusual was found in the practice.

All five companies manufactured products of a similar nature. Krupp and Edelstähle as well as Poldi produced sintered carbides. A study of the compositions manufactured in 1939 as compared with those manufactured in 1945 reveals some changes as a result of the lack of alloying metals. In 1939 there was a preference for high-speed steels containing about 13 per cent. tungsten, about 4 per cent. chromium, and a high vanadium content, fluctuating between 1½ and 5 per cent. The carbon content was increased proportionately with the vanadium content, in one case being as high as 1.50 per cent. with a cobalt content of 4.75 per cent. Many of the high-speed steels contained cobalt from 2 to 15 per cent.

Shortage of Alloys

As a result of the lack of alloying metals, a high-speed steel was developed containing up to 1 per cent. carbon, about 4 per cent. chromium, and a tungsten, molybdenum, and vanadium content each in the region of 2 to 3 per cent. The report points out that all the men engaged on the manufacture of this steel were enthusiastic about its performance. Dr. Houdremont of Krupps stated that it averaged about 20 per cent. better than a standard 18 per cent. tungsten high-speed steel for general application. All manufacturers admitted that it was very sensitive to grain growth and that it must be heat-treated within narrow temperature limits to obtain a good performance. The quenching temperature usually recommended was 1240°C. with a tempering temperature of 545°C., double-tempering being the standard practice, as with other high-speed steels However, it is interesting to note that Krupp manufactured this steel with a titanium content of from 0.05 to 0.1 per cent. On questioning other manufacturers of this steel as to whether they used any alloying elements or deoxidisers other than those stated, they invariably said no, and it appears that only Krupp used titanium. Dr. Houdremont stated definitely that if titanium was used the steel was more susceptible to grain growth. A number of tool makers were visited and in discussing the performance of this high-speed steel, they invariably stated that they considered it inferior to the standard types. Molybdenum high-speed steels did not find much favour in Germany, though several companies had licences to manufacture such steels. This may be explained by the fact that neither Germany nor its satellites produced appreciable quantities of molybdenum.

Steelworks near Trieste, belonging to the "Ilva" group, with an annual capacity of 95,000 tons, are reported to have been confiscated by the Allies on the request of the Yugoslav Government, which claims the works as reparations.

Non-Ferrous Metal Research

Mr. Morrison on the Need for Funds

ON the occasion of the 25th birthday of the British Non-Ferrous Metals Research Association, on November 21, the Lord President of the Council, Mr. Herbert Morrison, at a luncheon at the Savoy Hotel, London, spoke of the work that the Association had carried out in the quarter of a century of its existence. Their contribution to the war effort and to final victory, he said, was an important one, carried out under great difficulties.

During the 1914-1918 war corrosion of condenser tubes was a nightmare to the Admiralty. The non-ferrous laboratories developed and improved cupro-nickel tubing and a cheaper aluminium-brass alloy; and these two alloys are now the standard material from which condenser tubes for marine engines are made. In 1939-45 these tubes enabled the Navy to keep a high proportion of our warships at sea practically continuously and were a notable contribution to the winning of the Battle of the Atlantic.

Lead-Alloy Fuse

Another development which Mr. Morrison mentioned was "L-Delay." This completely novel delayed-action fuse was used on every front in the war from 1941 onwards. The principle of its working is the stretching of a lead alloy by spring loading until it breaks. In the hands of the resistance movements in Europe, L-Delay was used for detonating explosive charges and gave the Germans considerable trouble. The long-sighted policy of the D.S.I.R. helped this valuable work, for the non-ferrous metal scientists were not drafted to other forms of war service, and the team was held intact.

Although the Non-Ferrous Metals Control had its own technical staff for works problems, production difficulties, examination of defects in semi-manufactures and components, and problems concerned with the conservation of metals, they relied on the Research Association for background laboratory investigations. The Association carried out several complete research investigations for the Ministry, often in conjunction with producers of raw material and semi-manufactures, the results of which were applied by the Control. To mention only a few of these successes there was the valuable work on solder in relation to tin conservation; impurities in lower-grade copper which had to be used in pursuing ammunition programmes; laboratory work in micrographic examinations in connection with the banding of shells; and much technical advice on abstracts of information from technical journals. The Association rendered great assistance also to the Light Alloy Control of the Ministry of Aircraft Production.

Half their laboratory buildings, he said, had been destroyed in the blitz of 1940, and they were still working under a severe handicap of shortage of space, which he feared must continue until labour and materials are available to rebuild the laboratory block. The manner in which member firms rallied together to replace the records lost enabled the Association to overcome this serious blow.

The non-ferrous metals industry, Mr. Morrison continued, is one of the big industries of this country, with great possibilities for expansion. The Association's income has increased to nearly £45,000 a year, of which £13,600 is subscribed by the taxpayers and only about £25,000 by the industry. He was sure they would agree that the figure of £25,000 is not high enough for an industry which, even before the war, had an output valued at from £50 to £100 million a year.

Cutting the Time-Lag

Speaking of the need for increased research for British industry, Mr. Morrison referred to the time-lag between the initiation of research and its successful outcome, making it important to do everything possible, not at some vague time in the future, but now. As for what the D.S.I.R. was prepared to do, he remarked that it could safely be said that the achievement of a target of £70,000 a year in industrial income would not find the Department ungenerous in the matter of grant. Member firms should regard their subscriptions to the Association as an insurance, as an endowment policy for the enrichment of life and vigour.

The Research Association, intermediate between the universities and the industrial laboratories, was the only way by which a small firm could obtain the advantages of scientific research, but the large firms, even the largest, could also benefit greatly, for in the Research Association Laboratories work should be done on the longer-range problems which are common to the various sections of the industry. "Now is the time," he concluded, "when our Research Associations must take an increasingly important part in industry. You will have heard of the financial help that the Government is giving in a variety of ways and it is to be hoped that some of the money now available for ploughing back into industry will be made available by your mem-

ber firms to the British Non-Ferrous Metals Research Association."

Anniversary Volume

In commemoration of its 25 years of work, the British Non-Ferrous Metals Research Association has published an excellently-produced memorial volume, detailing the Association's policy and organisation, as well as reviewing its actual research work, both current and of the immediate past. The policy, as outlined by Mr. A. J. Murphy, chairman of the main research committee, has certainly been justified by the increase in membership since the foundation. The central nature of the organisation enables it to bring a wide experience to bear on specialised problems, which in themselves often provide information of more general interest than was envisaged by the actual question under examination. An *ad hoc* investigation, for example, may bring out the need for an extensive piece of fundamental research. By its very nature, the B.N.F.M.R.A. is in a position to take advantage of the situation, and to provide information of widest interest to all its members.

Dr. G. L. Bailey, the director, gives a brief and explicit sketch of the organisation of the Association, describing not only the concrete facilities available, but also the system on which its committees work and the method of securing liaison with the industry. His brief summary of the Association's actual work is expanded by Mr. W. C. F. Hessenberg (chief liaison officer) in a review of current work and recent research results. The majority of the findings have been published in the *Journal of the Institute of Metals*, and there is no need to detail them here; but it is worth noting that some of the researches have been extramural and that the Association gives support to certain investigations which are being carried out by other organisations. A perusal of this little volume establishes that Mr. Morrison's appeal to the industry to come forward with more funds is far from being unreasonable.

Heat-Resisting Steels

Address to Manchester Engineers

AT the meeting of the North-Western Branch of the Institution of Chemical Engineers on November 17, at the Manchester College of Technology, a paper on "Heat-Resisting Steels" was read by Mr. L. F. Keeley. Compared with other types of steel, he pointed out, heat-resisting steels possess superior strength at high temperatures and greater resistance to the scaling action of hot gases. Austenitic stainless and austenitic heat-resisting steels, ferritic stainless steel containing 12-14 per cent. chromium, and chromium iron containing up to 30 per cent. chromium, are types of heat-resisting steels which resist furnace gases below certain temperatures, except that chromium irons will not resist sulphur dioxide.

The addition of large amounts of chromium and nickel, with smaller amounts of other elements, to steel gives resistance to scaling or oxidation. Nickel increases the strength of chromium-iron alloys at high temperatures and chromium-nickel-iron alloys containing little iron possess a good resistance to creep under stress, but austenitic steels have a low yield point with a high ultimate tensile strength. High carbon contents in chromium-iron alloys are necessary for good castings and are not detrimental to the heat resistance of these alloys, but only alloys with low carbon contents will resist chemical corrosion. Chromium-iron alloys containing much chromium are brittle but this brittleness is decreased by the addition of a high-nitrogen "ferro-chrome" alloy.

For the selection of a suitable heat-resisting steel, a knowledge of the stress and the temperature to which the steel is to be subjected and the percentages of oxygen and of sulphur compounds in the furnace gases must be known. Sulphur compounds are injurious to nickel, but these alloys are the most suitable for furnaces containing reducing atmospheres where sulphur is absent. For the successful use of heat-resisting steels, the design of the plant is as important as the composition of the steel from which it is made; uniformity of section and the absence of sharp bends are desirable. Details of the composition of steels for various uses in industry concluded a very instructive paper.

A revival is reported in Chile's manganese mining industry. High-grade manganese dioxide, for use in batteries, is being shipped to the United States in substantial quantities, and orders from Sweden for other grades of ore have been received.

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Union Chimique Belge

Construction of Coke Ovens

THE annual report for 1944/5 of the Union Chimique Belge states that activity generally had been restricted by shortages of raw materials, electricity, fuels, and subsidiary supplies. Most plants had operated extremely irregularly, with consequent high production costs. Output of nitrogenous products had been exceptionally low owing to the destruction of the Zandvoorde electricity plant by the Germans, while the Houdeng plant had been used as a warehouse by the Allied armies. The company had, however, been able to develop certain special lines, such as pure products for analysis, phytopharmaceutical products, and specialities for the textile industries.

Pharmaceutical production had been continued in spite of all difficulties, and contact had now been resumed with the Belgian Congo, where the company's quinine plantation at Kivu was now in full production and had been able not only to feed the factory erected by the Colonial Government at Costermansville but also to supply quantities to various Allied Governments.

Activity in the refractory departments had been restricted by lack of coal, but the construction of a battery of coke ovens at the Usines Gustave Boë at La Louvrière had been continued, and the erection of a battery at Crachet-Pickery (for the Charbonnages Belges) completed. Reconstruction work had started on the by-product recovery plant of the Châtelineau cokery of the Soc. Métallurgique de Sambre et Moselle, which had also ordered the reconstruction of the Montigny cokery. The Soc. Belge de Fibranne and the Soc. Luxor had also ordered the reconstitution of their damaged plants at Zwijnaerde and Evere.

Fertilisers for France

Vastly Increased Demand

OFFICIAL estimates of French requirements of fertilisers for the 1945-6 season are placed at 490,000 tons of pure nitrogen (*azote*), 1,095,000 tons of phosphoric acid, and 1,070,000 tons of potash. These figures compare with a consumption in 1938-9 of 180,000 tons of pure nitrogen, 324,000 tons of phosphoric acid, and 297,000 tons of potash. The tremendous increase is, of course, due to the depredations made upon the soil fertility during the occupation. National production of fertilisers is far from being sufficient to meet these needs, and during the first half of 1945 supplied only 9 per cent. of nitrogenous and 14 per cent. of phosphatic fertilisers, as compared with 1938. The increase in industrial activity, very noticeable as from September, has allowed the distribution of larger tonnages to agriculture, but it is obvious that the full needs can only be covered by imports.

The Washington Committee has approved an import programme of more than 600,000 tons of nitrogenous fertilisers, of which, up to October 10, 65,600 tons had been received in the form of sodium, calcium and ammonium nitrate, and ammonium sulphate. Application has been made to the Committee for a million tons of phosphates, of which half has been granted, and 395,000 tons received by the end of September. Unfortunately, shortages of sulphuric acid, due to delays in the import of pyrites, did not allow of the manufacture of sufficient superphosphates to permit of satisfactory conditions for the autumn sowing. This deficit was to some extent offset by the use of nitric acid.

The potash problem offers a different picture. The reconquest of Alsace-Lorraine has made France the second largest producer of potash in Europe, and she has therefore no need of imports. But the supply to agriculture of pre-war tonnages depends on the provision of coal for the production of potassium chlorate, and on the possibilities of rail and water transport from the mines. At the moment, coal supplies are extremely short, and there is a growing difficulty in the supply of railway wagons.

Industrial Research Survey

Two F.B.I. Questionnaires

THE F.B.I. Industrial Research Committee and Secretariat have sent out questionnaires to establish the facts of Britain's industrial research. In the opinion of the committee, British industry's research effort has been greatly underestimated, because it is largely unknown. One questionnaire is addressed to all manufacturing concerns in the country that are carrying out research and development, and the second to all firms and organisations offering facilities to industry of an analytical, testing, consultant, research or development nature.

The first questionnaire seeks detailed information on the staffing and scope of a firm's research department. It asks, among other things, whether the firm's laboratories cater also for other British companies; what contacts exist with universities and technical colleges; whether the research department concerned wishes to be put in touch with others working in the same field, or to exchange scientific and technical information with others at home or abroad.

The second questionnaire, which has been prepared on similar lines to the first, asks the nature of the services offered, the particular field covered by the firm or organisation, and what specialist work is undertaken and equipment possessed.

Personal Notes

DR. J. S. H. DAVIES has taken up his duties as Director of Research of the British Schering Research Institute in succession to Professor D. H. Hey.

DR. J. R. CAMPBELL, Scientific Officer, Fuel Research Division, D.S.I.R., has been appointed Lecturer in Fuels at the Royal Technical College, Glasgow, on the retirement of Dr. G. S. Cruickshanks.

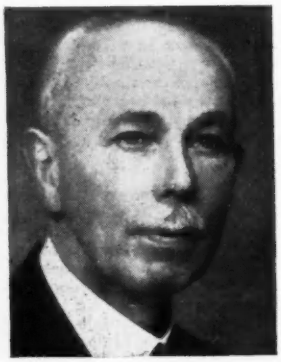
MR. T. L. BYWATER, Lecturer in Agriculture, University of Leeds, has been appointed to the Strathcona-Fordyce Chair of Agriculture at Aberdeen University in succession to Sir John Boyd Orr.

PROFESSOR V. M. TRIKOJUS, professor of biochemistry in the University of Melbourne, has been awarded the H. G. Smith memorial medal for 19945 by the Australian Chemical Institute, awarded annually for the best contribution to the development of chemical science in Australia.

The directors of the Gas Light & Coke Co. have filled the vacancies on the Court due to the death of Sir David Milne-Watson and the resignation of Sir Reginald Neville by electing MR. F. M. BIRKS and MR. M. K. MILNE-WATSON to be directors, as well as managing directors. Mr. Birks relinquishes his position of chief engineer and is succeeded by MR. N. WILLSMER.

Obituary

DR. FRANCIS WILLIAM ASTON, Sc.D., F.R.S., F.R.I.C., Fellow of Trinity College, Cambridge, who died at Cambridge on November 20, aged 68, holds a secure and permanent place in the front rank of physical chemists. A native of Birmingham, he was educated at Malvern and at Birmingham University, and after taking his degree entered industrial chemistry as research chemist at a brewery. He soon diverted his attention to private physico-chemical research, however, and in 1910 went to Cambridge to work under J. J. Thomson, eventually becoming his professor's assistant. Now and throughout his career his unrivalled ability in designing and dexterity in handling complicated apparatus served him in good stead, and he began work on the difficult subject of vacuum discharges, and later on the analysis of positive rays. This led to the study of isotopes, and he actually obtained a separation of the isotopes of neon in 1913—the first artificial separation of isotopes. In 1914-18 he was occupied on chemical problems connected with the war, but in 1919 he returned to the extremely accurate measurement of atomic masses, and by 1920 his determination of the isotopes of a large number of the elements was universally accepted. He was elected Fellow of the Royal Society in 1920 and Hughes Medallist in 1921, and in 1922 he received the Nobel Prize for Chemistry. The following years were spent in perfectin the technique of the mass spectrograph and in determining the relative abundance of isotopes, and in 1935 he published information leading to the discovery of "heavy water." In 1938 he was awarded the Royal Medal of the Royal Society for his separation of the isotopes of non-radioactive elements.



Dr. F. W. Aston, Sc.D., F.R.S., F.R.I.C.

MR. JAMES HENDERSON, a leader of the British iron and steel industry, died at Leatherhead on November 20, aged 77, after an operation. Among the many positions of influence which he held in the industry was the presidency of the Iron and Steel Institute in 1942-44, and he was also the last president of the National Federation of Iron and Steel Manufacturers (1934-35), being largely responsible for the changes leading to the formation of the British Iron and Steel Federation. Born and educated in Glasgow, he served in the laboratory of the Glasgow Iron Company at Wishaw, and in 1889 was appointed chief metallurgist of the Frodingham Iron & Steel Co. With this company, now the Appleby-Frodingham Steel Company, he maintained a lifelong connection, becoming managing director in 1920, and continuing as deputy chairman on retiring from active management in 1934. He received the Bessemer Gold Medal, the highest honour of the Iron and Steel Institute, in 1939, and was nominated an honorary member in 1944. A few months ago his portrait, by Oswald Birley, was presented to the Institute by the board of the United Steel Companies, Ltd. (of which Mr. Henderson was a director), in recognition of his lifelong service to the Institute and the industry.

General News

An amended schedule of regulations for operations at unfenced machinery in factories (1946) has been published by H.M.S.O., price 2d., post free.

The Royal Ordnance Factory at Marchwiel, Denbighshire, which ceased work last August, is to be established as a trading estate, the Board of Trade announces. About 1000 buildings are available.

Nordac, Limited, of Dukes Road, Acton, W.3, the well-known London chemical engineering firm, announce that they have acquired the business of S. Porter & Co., chemical plumbers, lead burners, etc., with works situated at 71 Scrutton Street, E.C.2.

A proposal has been made to hold an Exhibition of British Chemical Research, organised by I.C.I., in London during the early part of June, 1946. Arrangements are now being worked out and an announcement will be made shortly.

Only 45 new names are added to the list of those persons in neutral countries with whom dealings of any kind are unlawful according to the latest Trading with the Enemy (No. 12) Order (S. R. & O. 1945, No. 1447). Among them is " Magenti "—Manufactura General de Tintas—of Buenos Aires.

Arrangements have been made for an increase of 25 per cent. in the shipments of industrial explosives from Great Britain to Eire. Present shipments are about 50 per cent. of normal pre-war requirements and these are to be stepped up to 75 per cent. shortly. The Eire Department of Industry and Commerce states that official control over distribution is to be maintained.

The Board of Trade has not yet decided the future of the chemical factory at Valley Works, Rhydymwyn, near Mold, Flintshire, which has been operated by I.C.I., chiefly for the manufacture of gases, and employed several thousands at the peak period. Mold Council has also put forward the need for establishing a light industry in the town to take the place of the tinplate works, closed down before the war.

In submitting his annual report last week as chairman of the Court of Governors of Manchester University, Sir Ernest Simon, speaking of the Chemistry Department, said it was encouraging that they had been able to increase the number of students by 50 per cent. over the pre-war average, but only by overcrowding. A large hut was being built as an extension, but the Department would not be able to do its best work until it had a new building of about 75,000 sq. ft., on planning which the architects were now at work.

From Week to Week

The occurrence of a seam of torbanite in the Fife coalfield was reported on to the Edinburgh Geological Society last week by Mr. W. Manson. Found in the Boglochty coal-bed near Kinglassie, the seam varies from 7 to 15 in. in thickness, and from the testing of samples a yield of nearly 104 gallons of crude oil per ton was obtained.

The Royal Institute of Chemistry held its first social function for over six years—a dance at Slater's Restaurant, Kensington—on November 17. All 350 tickets were sold and there were applications for many more, and everybody attending expressed approval of the arrangements. It is hoped that this social affair will be the forerunner of many more.

A meeting of the International Executive Council of the World Power Conference was held in London on November 20 and 21, in order to discuss the post-war revival of the activities of the Conference. Sir Harold Hartley presided and about 20 countries were represented. It was decided to hold a sectional meeting in 1947 to discuss the general question of fuel economy and to resume publication of the statistical year book as soon as possible.

Dorman Long's new investment project, just announced, which is to cost £9 million over a period, includes, principally, the construction of a universal beam mill, the first in this country. The use of beams instead of joists in constructional steel, an adaptation of American practice, saves both in weight of steel and in cost of fabrication. The mill will produce 350,000 tons of beams a year, the country's estimated total requirement. A large new open-hearth steel plant is also to be built, integrating the company's Cleveland and Redcar plants.

A new company to trade in reconditioned plant and machinery of all types, especially hydraulic machinery and plant for the plastics, rubber, chemical and process industries, has just been formed. Its title is Reed Brothers (Engineering), Ltd., and three of the four directors have recently resigned from long-standing appointments with George Cohen, Sons & Co., Ltd. They are Mr. H. E. Reed, late manager of the hydraulic, plastics and rubber machinery department, Mr. O. O. Fogg, formerly assistant manager of the same department, and Mr. G. W. Reed, who for 27 years held the position of chief valuer. The new company will also undertake the conversion and manufacture of special plant items to customers' requirements, as well as maintaining, dismantling and installing plant and machinery.

We are asked, by Baird & Tatlock (London), Ltd., manufacturers of the "New Empire" Analytical Balance, Mark V, to mention that owing to an inadvertence on their part, the sensitivity of the instrument was quoted, in their announcement in our issue of November 10 (p. ix), as 0.1 gm. This should, of course, have read 0.1 mgm.

At the 11th meeting of the Manchester Group of the I.S.L.T.C. on November 17, Mr. Cheshire advocated "A New Method for the Experimental Aging of Leather." He recommended the use of sulphur dioxide and oxygen, at one and seventeen atmospheres pressure respectively and 40° C., for the accelerated aging of leather. Six days were sufficient for the test. In a second paper, Mr. W. R. Atkin gave a survey of the chemistry of vegetable tannins.

Foreign News

In Kazakstan, an Academy of Sciences is to be established with a staff of 1500.

Sweden's imports of aniline dyes increased slightly to 1544 metric tons in 1944 from 1424 tons in 1943, but they were substantially below the 1939 figure of 2903 tons.

The central office for the chemical industry recently established in Poland, has eleven wholesale departments and ten regional sales offices.

In fulfilment of a Russo-Polish agreement, a large furnace for the production of calcium carbide is being built in Poland. This will assure a production of 5000 tons of carbide, which is to go to the Soviet Union.

New match factories are to be opened in Danzig and in western Poland, in addition to the three plants at Lodz, Czestochowa, and Czechowice. Monthly production now amounts to 50,000,000 boxes, and 1000 workers are employed in the industry.

In Peru, special studies are being made by analyses and tests to improve the quality of coal offered for export. Equipment for the establishment of a complete coal laboratory, which is on order, is expected to assist greatly in further coal research.

The U.S. Department of the Interior plans a three-year programme to provide a complete geological survey, while the Bureau of Mines intends to carry out a ten-year survey of every existing reserve of coal minerals and metals as soon as Congress approves the necessary money.

The Japanese have not done much damage to the cinchona plantations in the Netherlands Indies. Before the war, the Kina Bureau, a Dutch corporation, controlled 90 per cent. of the world's quinine, but now it is faced with keener competition from other Far Eastern and Latin American sources and more particularly because of the development of substitutes.

The effective man-power of the French chemical industries, according to a statement in *France*, is this year only 80,000, compared with 102,000 in 1938, while the number of iron and steel workers has fallen from 125,000 to 72,000. All the principal industries show a greater or less reduction, except for coalmining, which benefits for the time being by the employment of 28,000 prisoners of war.

The Belgian Colonial Office has issued statistics for the mineral production of the Belgian Congo and Ruanda-Urandi for 1944, showing that copper output totalled 157,000 tons, zinc production 22,000 tons, manganese 20,000 tons, tin 19,500 tons, wolframite 300 tons, tantalum-columbite 200 tons, silver 76 tons, unrefined gold 15 tons, and cadmium 13 tons.

Fluorspar production in Spain during 1944 amounted to 55,000 tons, compared with 36,000 tons in 1943 and 48,000 tons in 1942. Annual production could be increased to 60,000 tons, including 10,000 tons of acid spar. The most important Spanish fluorspar mines are in Oviedo province, near Gijon and Ribadesella, capable of producing metallurgical spar of between 89 and 91 per cent., with 5 per cent. silica. There is a modern flotation plant capable of producing about 50 tons per day of acid grade, in flotation concentrates.

According to a geologist of the mining division of the Argentine Ministry of Agriculture, Argentine sources of uranium ore are located in the Cañada de Alvarez zone of the province of Córdoba, and consist of gummite, autunite and torbernite. The deposits are in the so-called "Sierra de Comechingones" which separates the province of Córdoba from the province of San Luis, about 2180 metres above sea level. Water is abundant, but hard timber must be carted. The mines can be worked at all seasons as the climate is excellent.

Forthcoming Events

December 3. Society of Chemical Industry (London Section). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.15 p.m. Mr. W. G. Atkins: "Jute and the Chemical Industry," and Dr. A. J. Turner: "The Properties and Uses of Flax."

December 4. Royal Institute of Chemistry (Huddersfield Section) and **Society of Dyers and Colourists.** Field's Café, Huddersfield, 7.30 p.m. Mr. R. G. Heyes: "Some Aspects of Thermo-setting Plastics."

December 4. Electrodepositors' Technical Society (Birmingham Section). James Watt Memorial Institute, Great Charles Street, Birmingham, 6.30 p.m. Mr. J. P. Gill: "The Dyeing of Anodised Aluminium."

December 4. Royal Institution of Great Britain, Albemarle Street, London, W.1, 5.15 p.m. Sir Henry Dale, Pres. R. S.: "Recent Developments in Chemical Therapeutics. I—In the Beginning. Dyes, Arsenicals, Antimonials, etc."

December 5. Society of Public Analysts and **S.C.I.** (Food Group). Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1, 6.15 p.m. A number of papers on: "New Routine Tests and their Application in Modern Food Industry."

December 6. The Institute of Fuel (East Midland Section). Demonstration Theatre, Gas Department, Nottingham, 3 p.m. Dr. J. W. Whitaker: "The Training of Fuel Technologists."

December 6. Society of Chemical Industry, Chemical Engineering Group (Bristol Section) and **Institution of Chemical Engineers.** University Chemical Department, Woodland Road, Bristol, 5.30 p.m. Mr. Stanley Robson: "Chemistry, Metallurgy and Empire." (First Robert Horne Memorial Lecture.)

December 6. Chemical Society. Burlington House, Piccadilly, London, W.1, 5 p.m. Mr. G. R. Clemo and Mr. W. Cocker: "The Constitution of *pseudo*-Santonin" (Parts I and II): Mr. A. H. Cook, Mr. K. J. Reed, Mr. R. M. Anker and Mr. I. M. Heilbron: "Experiments in the Piperidine Series" (Parts I-III), and Mr. H. M. Powell and Mr. G. W. R. Bartindale: "Structure of Compounds of Ferrocyanide Type" (Part I).

December 7. Andersonian Chemical Society. Royal Technical College, Glasgow, 3.30 p.m. Mr. R. H. S. Robertson: "Some Principles of Raw Material Development—with Scottish Examples."

December 7. Institute of Welding (South London Branch). Borough Polytechnic, Borough Road, London, S.E.1, 7.30 p.m. Mr. G. Haim and Mr. H. P. Zade: "Welding of Plastics."

December 7. Chemical Society (Manchester Section) and **Royal Institute of Chemistry.** Chemistry Lecture Theatre, Manchester University, 6 p.m. Professor J. M. Robertson, F.R.S.: "The Principles of Crystal Analysis."

December 7-8. British Association for the Advancement of Science (Division for the Social and International Relations of Science). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, 10.15 a.m. and 2.15 p.m. Conference: "Scientific Research and Industrial Planning." Speakers include Dr. M. Polanyi, F.R.S., Sir Edward Appleton, F.R.S., Dr. E. F. Armstrong, F.R.S., Professor P. Sargant Florence, and Sir Arthur Fleming.

December 8. Institution of Chemical Engineers (North-Western Branch). Reynolds Hall, College of Technology, Manchester, 3 p.m. Mr. F. P. Lett: "Planned Maintenance in a Chemical Works."

December 10. Institute of Fuel (North-Eastern Section) and **Coke Oven Managers' Association.** Central Station Hotel, Newcastle, 5.30 p.m. Mr. T. C. Finlayson and Mr. A. Taylor: "The Design of Regenerators with special reference to Coke Ovens."

December 11. Society of Chemical Industry (Nutrition Panel) and **Institute of Brewing.** The Horseshoe Hotel, Tottenham Court Road, 6 p.m. Dr. F. W. Norris: "Carbohydrate, Nitrogenous, Mineral and Alcohol Constituents of Beer," and Mr. J. W. Tullo: "Vitamins in Beer."

December 11. Royal Institution of Great Britain. Albemarle Street, London, W.1, 5.15 p.m. Sir Henry Dale, Pres.R.S.: "Recent Developments in Chemical Therapeutics. II—Sulphanilamide and its Derivatives."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COLIN STEWART, LTD., Winsford, chemical manufacturers. (M., 1/12/45.) October 19, mortgage and debenture to District Bank, Ltd., securing all moneys due or to become due to the Bank; charged on certain lands at Winsford & Coed Talon, also land and buildings at Coed Talon (subject to, etc.), and a general charge. *Nil. December 31, 1943.

KNIGHTS OIL & CHEMICAL CO., LTD., Birmingham. (M., 1/12/45.) October 26, £900 mortgage to J. E. Cox, Wylde Green; charged on 162 Victoria Road, Aston, Birmingham. *—. May 30, 1945.

Satisfactions

FREDERICK ALLEN & SONS (PGPLAR), LTD., London, E., chemical manufacturers. (M.S., 1/12/45.) Satisfaction November 2, of charge registered May 18, 1939.

LUMA PRODUCTS, LTD. (formerly G. P. K. CHEMICALS, LTD.), London, N. (M.S., 1/12/45.) Satisfaction October 30, £2000, registered November 25, 1939.

Company News

Chloride Electrical Storage Co., Ltd., is paying an interim dividend of 5 per cent. (same) on the "A" and "B" ordinaries.

Lawes Chemical Co., Ltd., has declared a first and final ordinary dividend of 6 per cent. (same).

Griffiths Hughes Proprietaries, Ltd., are paying an interim dividend of 4 per cent. (2 per cent.).

Midland Tar Distillers, Ltd., report a net profit, for the year to June 30, of £39,381 (£30,197). An ordinary dividend of 7 per cent. (same) has been declared.

North British Rayon, Ltd., with a net profit of £28,785 (£22,561), is paying an ordinary dividend of 7½ per cent. (same) for the year ended June 30.

Sandoz Chemical Co., Ltd., Bush Lane House, London, E.C.4, have increased their nominal capital beyond the registered capital of £20,000, by the addition of £80,000 in £1 shares.

British Benzol & Coal Distillation, Ltd., report a profit, for the year to October 31, of £24,168 (£29,574). A final ordinary of 5 per cent., and a bonus of 5 per cent., make a total distribution of 15 per cent. (same).

Tate & Lyle, Ltd., are paying a final ordinary dividend of 10 per cent., making 13½ per cent. (same) for the year ended September 30. Net profit is £511,893 after transfer of £100,000 to general reserve, against £517,455 for last year, when no allocation to reserve was made.

British Nylon Spinners, Ltd., formed in 1940 jointly by I.C.I., Ltd., and Courtaulds, Ltd., has increased its capital from £300,000 to £1,000,000, of which £800,000 is now issued and paid up. This increase of capital will cover expenditure, during 1945, on the building of a large plant at Pontypool.

Chemical and Allied Stocks and Shares

INTERNATIONAL uncertainties and the Government's nationalisation "time-table" had a restraining influence on stock markets, but the volume of business was well maintained, largely owing to increased activity in South African gold mining shares. Home rails receded and colliery shares lost ground, while among other nationalisation groups, electric supply and road transport securities were again lower. British Funds continued active, but an earlier rally was not held, the disposition still being to await the outcome of the Anglo-U.S. loan talks, and also the Government's next cheaper money move, which, according to some views, may follow the termination of the Thanksgiving Savings Campaign.

Shares of chemical and allied companies reflected the active business in markets, but movements on balance were mostly small and unimportant. Various shares attracted more attention on estimates as to the effect of abolition of "double taxation" resulting from the new Dominion income tax relief basis, which will result in higher gross payments from companies with important interests overseas. Imperial Chemical were around 40s. 9d., Turner & Newall 85s. 6d., Dunlop Rubber 54s. 6d., United Molasses 44s. 6d., and Distillers 118s. A little profit-taking put back General Electric to 96s. 9d., and Lever & Unilever also eased slightly to 52s., but elsewhere, among paint shares Lewis Berger made further headway to 125s. 7½d. pending the dividend announcement.

Dorman Long showed firmness at 26s. 3d. on the company's expansion programme, but the iron and steel section generally recorded moderate declines, with Babcock & Wilcox 58s. 3d., Guest Keen 40s. 3d., Staveley 47s. 6d., Shipley 26s. 6d., and United Steel 24s. 1½d. Stewarts & Lloyds at 57s. 9d. failed to hold all an earlier rise, although the company will benefit from the higher Tube Investments payment in view of its shareholding in the latter. Textiles have been steady, with Bleachers 14s., Calico Printers 21s., and Bradford Dyers 26s. 10½d. British Celanese, after a further rally attributed to American buying, receded to 34s. Courtaulds were 58s. 9d. In other directions, the higher interim dividend advanced Griffiths Hughes to 51s. Beechams were 22s. 7½d., Sangers 31s., Timothy Whites 44s., and Boots Drug 5s. ordinary 56s. 6d.

British Plaster Board have been around 35s., and Associated Cement 62s. 6d., but Wall Paper deferred receded further to 41s. 3d. on the chairman's cautious remarks about the immediate outlook. B. Laporte kept at 87s. W. J. Bush were 78s. 9d., and British Drug Houses active around 50s. Burt Boulton were 27s., Fisons 58s., and Lawes Chemical 10s. ordinary 12s. 9d., while Monsanto Chemicals 5½ per cent. preference kept at 23s. Greeff-Chemicals Holdings 5s. ordinary were 9s. 6d., and British Industrial Plastics 2s. ordinary have been more active around 7s. 4½d. De La Rue were £11, Erinoid 5s. ordinary 12s. 6d., and British Glues & Chemicals 4s. ordinary 12s. 7½d. Cellon 5s. shares kept their recent rise to 27s.

Gas Light & Coke receded to 21s. 3d., but later rallied on the termination of the unofficial strike. British Lead Mills 2s. shares were 5s. 6d., British Tar Products 5s. ordinary 12s. 6d., and William Blythe 3s. shares 12s. 3d. Gas Purification & Chemical £1 ordinary were quoted at 22s. 6d., and Permutit 5s. shares at 13s. 9d. Among oil shares, Anglo-Iranian at 107s. 6d. continued to be affected by the news from Persia, and Burmah Oil eased to 80s., while, after 85s., Shell receded to 83s. 9d. Canadian Eagle Oil have been active up to 21s. 9d. on talk of pending developments.

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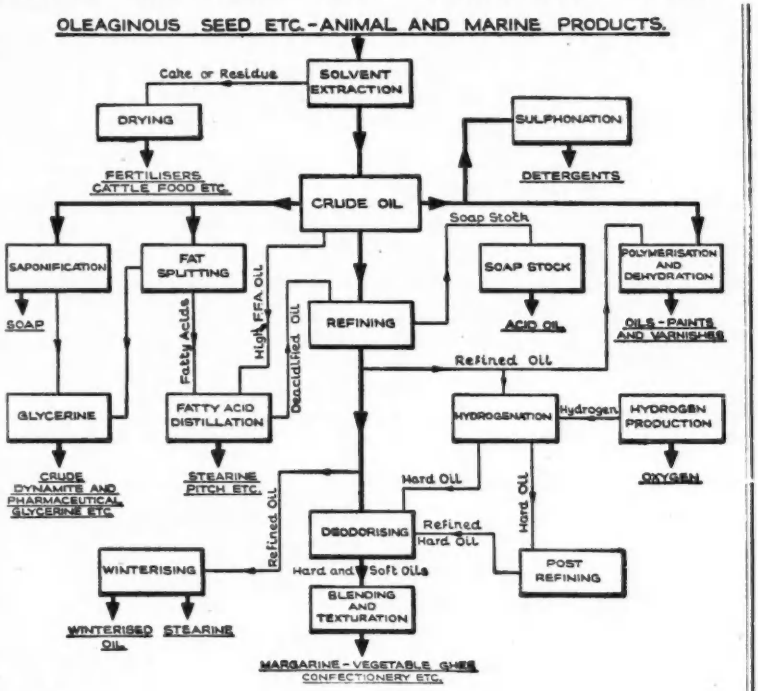

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British Chemical Prices

Market Reports

A STEADY trade in heavy chemical products has been experienced during the week in the London market, and a fair amount of inquiry is reported chiefly from home consumers, although the demand for materials for export trade has been quite satisfactory. The price position throughout remains firm. Among the soda products a fair inquiry is reported for the sulphides and a steady movement in supplies of percarbonate of soda has taken place. The demand for chlorate of soda continues to exceed the quantities available despite the improvement in the supply position. Acetate of soda is steady and nitrite of soda continues to attract moderate attention. In the potash section interest in caustic potash keeps up at recent levels and offers are finding a ready outlet, while the demand for permanganate of potash continues on steady lines. Acid phosphate of potash is a good market and fresh inquiry for the limited supplies of yellow prussiate of potash is reported. A fairly good demand continues for the crude and refined grades of glycerine, and an active market is reported for calcium carbide and white powdered arsenic. Fresh inquiry is reported for British-made formaldehyde, while hydrogen peroxide is in steady request. Trading conditions in the coal-tar products section have shown little change on the week.

MANCHESTER.—Chemical prices generally have been steadily maintained on the Manchester market during the past week and only in one or two spots are any indications of easiness in evidence. Industrial users of the leading heavy chemicals, including the alkalis and the acids, are taking steady deliveries under contracts, and a moderate weight of new home trade business has been reported. Export inquiries during the week have been fairly plentiful. Basic slag, lime, superphosphates, and sulphate of ammonia are the most active departments in the fertiliser section. A moderate home trade is being done in the by-products, with pitch and some of the light materials fairly active on export account.

GLASGOW.—Business in the Scottish heavy chemical trade during the past week has improved considerably. Prices remain firm. There is no change to report in export trade.

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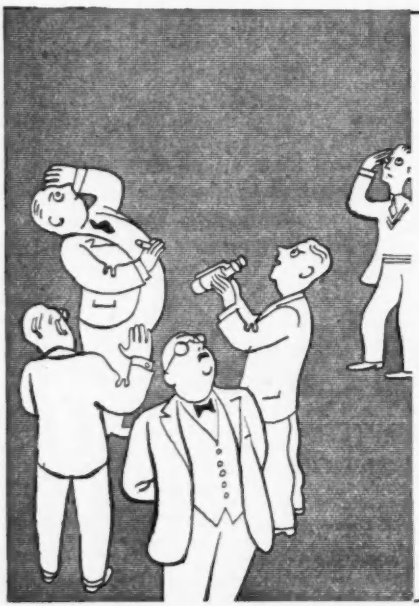

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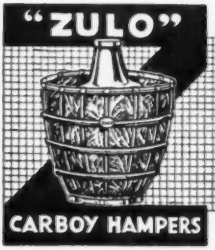

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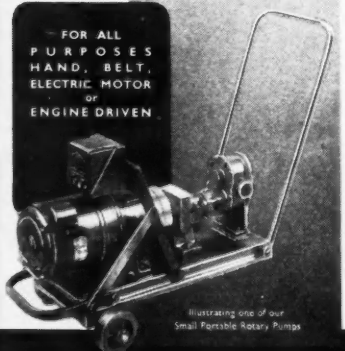

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